

La déesse égyptienne Nout personnifie la voûte céleste elle est ici représentée par l'image de la Vache céleste ; son ventre est parsemé d'astres. On notera également la course du soleil. Tombe du pharaon Séthi Ier (1321-1301 av. J.-C.), Vallée des Rois ; aquarelle de H. SALT, exécutée en 1818.

“The ancient Universe was confined within a finite spherical shell. The stars were fixed to this shell and thus were all equidistant from the Earth, which was at the centre of the spherical universe. This simple model is still in many ways as useful as it was in antiquity : it helps us to easily understand the diurnal and annual motion of stars, and more important to predict these motions in a relatively simple way. Therefore we will assume for the time being that all the stars are located on the surface of an enormous sphere and that we are at its centre. Because the radius of this celestial sphere is practically infinite, we can neglect the effects due to the changing position of the observer, caused by the rotation and orbital motion of the Earth” (H. KARTUNEN et al., Fundamental Astronomy, Berlin, Springer Verlag, 1994, p. 15).

□ The Celestial Sphere in Ancient Egypt

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Résumé : *La sphère céleste en Ancienne Égypte* — Les auteurs ont relevé dans l'introduction de l'hymne au dieu-soleil Ra du *Papyrus Ani*, l'existence du mot égyptien

☐  ☉, mot qui, avec le déterminatif ☉, ne figure dans aucun des dictionnaires

majeurs de la langue égyptienne [LESKO (1982), and FAULKNER (1991), y compris le *Worterbuch* de ERMAN and GRAPOW (1926)].

Ils montrent dans cet article qu'il s'agit d'un **terme d'astronomie** qui désigne la **sphère céleste**.

Abstract : *The Celestial Sphere in Ancient Egypt* — In reading the introductory hymn to the sun-god Ra in the *Papyrus of Ani*, attention of authors was immediately

attracted by the egyptian word ☐  ☉. Neither of the major dictionaries of the

ancient egyptian language [LESKO (1982), FAULKNER (1991) and the *Worterbuch* of ERMAN and GRAPOW (1926)] have this word with the determinative of the sun ☉. In this paper, they show that it is an **astronomical term** which means the **celestial sphere**.

1. Introduction

Although Egyptian astronomical contributions to civilization such as calendar making and astrological prognostication are widely acknowledged, there still exists a prevalent belief that the Egyptians had little to say in the realm of astronomy.

In order to engage Egyptian knowledge of astronomy, *The Book of the Dead* or, more precisely, *The Book of Going Forth by Day* in the new edition translated by Raymond FAULKNER (1994) is essential reading. In reading the introductory hymn to the sun-god Ra in the *Papyrus of Ani*, our attention was immediately attracted by a very important question. Indeed, the first sentence of that introductory hymn dealt obviously with the **celestial sphere**.

Through focusing on the celestial sphere, we introduce critical aspects of Egyptian astronomy as they have been articulated by Egyptians themselves. In doing so, we seek to illuminate a small, but significant, part of the map of the terrain of Egyptian astronomy that will help facilitate more descriptive scientific explorations into Egyptian knowledge.

Before presenting and explaining the Egyptian text, let us recall the meaning of the celestial sphere in modern astronomy.

2. The Celestial Sphere and its Defining Components

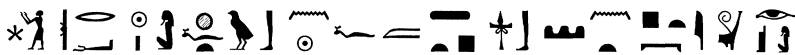
The celestial sphere is the imaginary sphere surrounding the Earth on which all heavenly bodies are projected. It is, so to speak, the vault of the sky as it appears to be spread above us.

This celestial sphere of stars surrounds the Earth on every side. In the daytime we can not see the stars because of the superior light of the sun. As the Earth rotates, the celestial poles seem to remain stationary, while the rest of the sky moves around. Because the celestial sphere is divided into two equal hemispheres by the celestial equator, one half of the celestial sphere is constantly visible to us which is dependent upon the observer's position on Earth. If the observer is North of the equator, the south celestial pole can not be seen, as it always stays below the horizon; similarly, observers south of the equator can not see the north celestial pole.

On the surface of the celestial sphere, which is concave, the three primary circles that are imagined are crucial to an understanding of the more common problems of astronomy. These are the celestial horizon, the celestial equator, and the ecliptic.

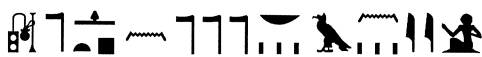
The celestial horizon is a great circle defined by the intersection of a plane perpendicular to the plumb line and the celestial sphere. This alone may be thought of as passing through the observer, or through the center of the Earth. The visible horizon is usually two or three degrees above the true one. This can be determined easily by timing the rising and setting of heavenly bodies such as the rising sun. In ordinary level but rolling country one must be on the top of a hill to see the sun rising or set. The astronomer usually defines the plane of the horizon with a surface of mercury, which by physical laws must be a level surface.

3. The Celestial Sphere in the Introductory Hymn to the Sun-God Ra



dw3 R` hft wbn.f m 3ht í3by(t) nt pt ún Wsír

Praising Ra when he rises in the eastern horizon of the sky by the Osiris (the dead),




sš htpw - ntr n ntrw nbw 3ny

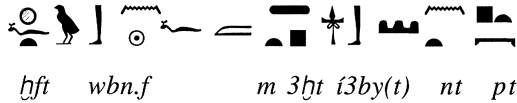
the scribe of the divine offerings of all the gods, Ani.

Now that we have dealt with the definition and description of the celestial sphere and its components, let us embark on examining the astronomical content of this introductory

hymn to the sun-god Ra. The Egyptians knew quite well the life-giving power of the sun (*ra*). Thus, they did worship (*dw3*) the sun (*ra*) as a god (*Ra*).


In addition, they knew the sun's motion from East (left) to West (right). Indeed, all stars on the celestial sphere rotate from East to West, and the sun is the day star. The celestial sphere is the blue vault of the sky ( *pt*), as it appears to be spread above us.

The celestial horizon, the great circle defined by the intersection of a plane perpendicular to the plumb line and the celestial sphere, is clearly delineated in the text :








When he (the sun-god) rises in the eastern horizon of the sky.


This reference to the eastern horizon [] of the sky

( *pt*) suggests that this is a clear astronomical observation that represents Egyptian knowledge of the celestial horizon. Hence, they obviously knew of one of the imaginary circles projected on to the celestial sphere. Of course, the Egyptians also knew the visible horizon because they have drawn it as follows :

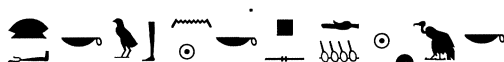


The visible horizon is the line where the Earth and the sky seem to meet. On land, it is regular : sun rising over mountain. Thus, the precise meaning of *3hft* is : the place in the sky (*pt*) when the sun (*ra*) rises (*wbn*), and the Earth ( mountain) and the sky () seem to meet. The Egyptian astronomers must have been on the top of a hill () to see the sun-rise in order to calculate the time of the true sunrise.

 *3hft* "horizon" : the sun-rise is still within its land () , that is, the sun is ready to appear in the horizon.







 *3hft* "horizon" : the sun-rise is two or three degrees above the level of the visible horizon.



It seems that the Egyptian astronomers possessed the knowledge of a full horizon system dealing with the celestial sphere because of their knowledge of both the celestial and visible horizon. Implicit in the knowledge of the celestial horizon is the knowledge of the celestial sphere, but to provide further concrete evidence for the Egyptian astronomical observations of the celestial sphere it becomes necessary to precisely show what the Egyptians called the celestial sphere.






ḥꜥ.í.k wbn.k psd mwt.k
 You rise and shine on the back of your mother (the sky).

From our textual analysis of the introductory hymn to the sun-god Ra, the celestial sphere

was called (  ) *psdw*, *psd* by the Egyptians. (  ) *psdw*, *psd*



means "back" or spine and the determinative ☉ generally denotes meanings dealing with the sun or time. Of course, the determinative provides us with the precise sense of how the forgoing sound-signs should be defined and described. If *psd* ("back", "spine") was a question of anatomy, the determinative would be  (a piece of flesh). The "back" or "spine" is not to be taken literally in this passage. Indeed, the Egyptian use of two determinatives, one being the backbone and ribs () and the other being the sun ☉



suggests that they themselves did not want *psd* (   "back") to be taken

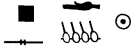
literally. In this passage, *psd* is used metaphorically by the Egyptians to reveal an astronomical observation. This is not a question of anatomy; it is a question of astronomy. Indeed, the astronomical meaning of *psd* in this passage is the celestial sphere. The heavenly bodies are seen against the blue vault of the sky, the celestial sphere. This sphere is a sphere of stars shining and the sun ☉ symbolizes all stars. One half of the celestial sphere (against which the stars are seen) is constantly visible to us. The surface of the celestial sphere is concave, and the Egyptian astronomers used the image of "back" of a bent woman to convey this.

4. Discussion

Numerous scholars have possessed a built-in skepticism concerning Egyptian scientific innovation, particularly when it comes to a field of scientific inquiry such as astronomy. Distorted scholarship becomes a consequence of the ideological positions of many of the chroniclers of Egyptian civilization. Neither of the major dictionaries of the Egyptian language written by ERMAN and GRAPOW (1926), LESKO (1982), and FAULKNER (1991)

have the word *psd* ( ) with the determinative of the sun ☉ that represents the term that Egyptians equated with the celestial sphere. BUDGE (1898) does correctly

replicate the word *psd* (  ☉) with the determinative of the sun ☉ in his translation of the *Papyrus of Ani*, but he wrongly translates the passage as "thou risest up in the sky, illumining thy mother (Nut)" which does not speak to the specific meaning of

celestial sphere. Because the writing of this word, *psd* () does not exist in any dictionary, it is our responsibility to assert that the meaning of this word be placed in any future editions of dictionaries on the Egyptian language. Although publicizing our findings would be a major step forward, it should be accompanied by a reexamination of what is considered historical evidence around Egyptian astronomy and an inclination to ask new questions about the language.

This introductory hymn to sun-god Ra in the *Papyrus of Ani* not only shows that the notion of the celestial sphere existed in Egyptian civilization; it also is an indication that this papyrus must have been written by an Egyptian astronomer. Even as our findings contribute to the study of classical African civilizations, we must begin to further research Egyptian civilization from the inside and begin to open our minds so that we can reassess the theoretical constraints of many interpretations of these historical sources. As we receive a sense of historical identity, awareness and continuity from classical African civilizations, our historical and cultural traditions demand that we scholarly engage them scientifically and seriously.

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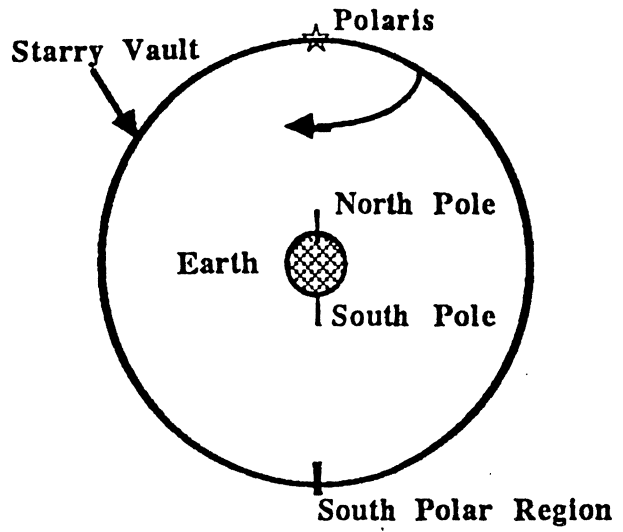
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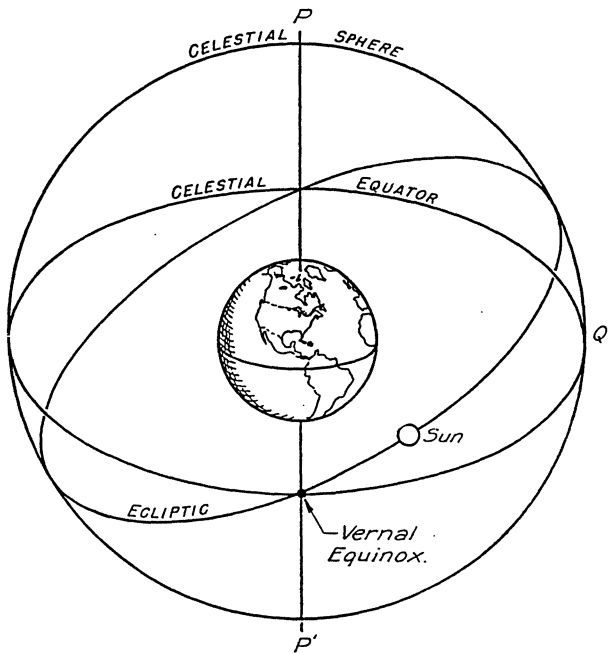
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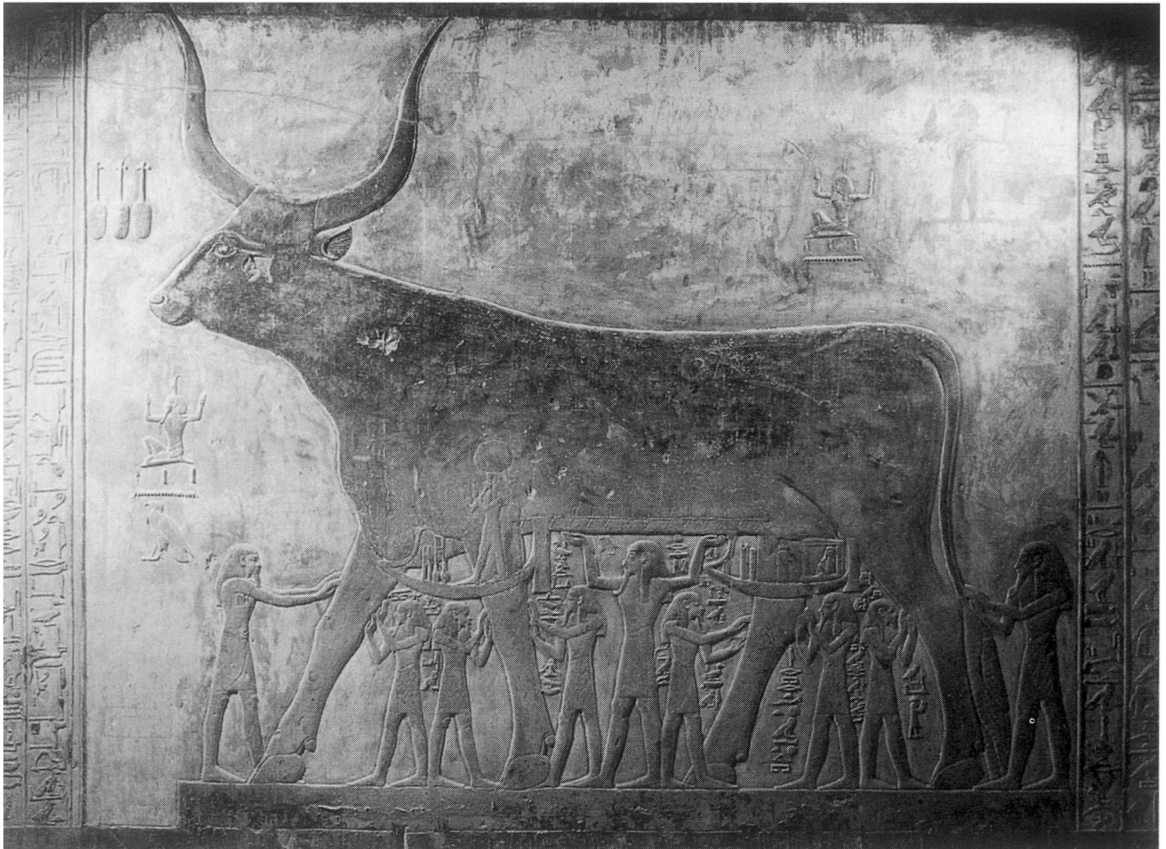


THE CELESTIAL SPHERE



The Vernal Equinox Is Marked by the Intersection of the Ecliptic and the Celestial Equator

The Celestial Sphere



La déesse égyptienne Nout personnifie la voûte céleste, et elle représentée ici par l'image de la Vache céleste ; son ventre est parsemé d'astres. On notera également la course du soleil. *Tombe du pharaon Séthi Ier (1321-1301 av. J.-C.), Vallée des Rois.*