

Astronomical Alignments in the Temples of Egypt

by David Furlong

In my early visits to Egypt, which started in 1991, I often used to stand on the central axis of different temples and wonder at the alignment intention of their founders. In those early days there was no simple way of determining accurately temple azimuths or any potential astronomical connection. The development of mapping programmes like Google Earth and astronomical software such as StarCalc has changed this position. We now know from the extensive field work of Shaltout, Belmonte and Fekri¹ that astronomy played a significant part in the foundation alignments of all Egyptian temples. This article looks at two temples that I have extensively researched and photographed; the great temple of Amun-Ra at Karnak and the temple of Queen Hatshepsut at Deir El Bahari, both of which are principally aligned to the mid-winter sunrise.

In the spring of 2007 I first began to look at the ground plan of some of the clearly discernible temples using Google Earth and to make some calculations on temple alignments. It soon became clear that a number of temples in ancient Waset (Luxor) were on the same azimuth. These included the central axis of Ipet-Isut at Karnak, the temples of Montuhotep II and Queen Hatshepsut at Deir El Bahari and the temple of Amenhotep III at Qurna. Their azimuth of 116° coincided with the mid-winter sunrise at the latitude of Luxor. Potential solar and lunar alignments are quite easy to confirm because both the sun and moon still rise very close to the same azimuths that they did five thousand years ago. This is why we can still experience solstitial sunrises in places like Stonehenge in England and New Grange in Ireland. Stellar alignments, such as to Sirius, are more complicated because of precession and require computer calculations to determine. Whilst theorising such alignments they can only truly be experienced on the ground and that winter I visited Luxor with the express intention of witnessing the winter solstice in both Karnak and Deir El Bahari. The experience was, without doubt, one of most powerful of my life and since that time I have taken hundreds of

photographs demonstrating the way that the use of sunlight could have been used as part of temple ritual.

Hatshepsut's Mortuary Temple - Djeser Djeseru

I was fortunate to be able to obtain permission to witness the solstice from within the inner central chapel of Queen Hatshepsut's temple. The horizon that day was slightly obscured by hazy cloud and I could not be sure that we would see the sunrise. Yet right on cue, at 6.35 am the sun rose on the central axis of the temple casting a beautiful pink light on the rear wall of the innermost chamber. Any statue positioned there would have been bathed in this morning glow. As we watched the light became golden and then quickly moved off the alignment. We initially thought this was the end of the light show. However we then became aware of a small square block of sunlight that illuminated the scene of the upper semi-circle wall in the first of the inner chambers. The right of this scene showed Thutmosis III making an offering to the god Amun, the left hand side showed a corresponding image of Hatshepsut. This left side had been badly defaced but the position of the kneeling queen in front of the seated Amun could still be discerned. As we watched, over the space of about three quarters of an hour, the box of bright light, moved off the central axis, first to Amun-Ra, then to Tuthmosis and eventually to the image of the Nile god Hapi that sat just below the register.

Closer observation of the three chambers showed that an additional inner 'light box' existed. It is possible now to stand in the innermost chamber and to see the sky through the inner and outer 'light boxes', yet the height angle did not correspond to the mid-winter solstice but to two dates on either side. From careful measurements and calculations I was able to determine that this would have fallen close to forty-two days on either side of the solstice. In January 2011 I gained permission from Dr Zahi Hawass from the Supreme Council of Egyptian Antiquities to photograph from within the inner sanctuary and over the space of several days took a series of photos showing the march of the sun as it climbed higher and higher in the sky until on 1st February it first illuminated Hatshepsut

before penetrating through the two 'light-boxes' into the inner chamber, this was 42 days after the solstice in 2010. However the alignment was not quite exact in relation to the position of the sun along the central axis of the temple. Unfortunately I had to leave Egypt that very day and was unable to record what then happened next.

I managed to be back to Egypt again this year (2013) and photographed the same event on the 4th February. By this stage, although the sun briefly penetrated through to the inner chamber the square box of brilliant sunlight had already dropped below the inner 'light-box' by the time the sun was directly in line with the temple entrance. This would have been 44 days after the solstice in 2012. The Polish team are at present working on this phenomenon and no doubt, in time, we will further benefit from their observations. Whether it was the moment of first penetration of sunlight through the 'light-boxes' or a day or two later that was the significant date from Senenmut's perspective we cannot yet be sure. What is clear is that for whatever reason an alignment of sunlight occurs around 7.30 am through the boxes between 7th to 10th of November and the 1st to 4th of February each year. This is echoed in the well known twice yearly alignment of the Abu Simbel temple, which is considered to mark the coronation or birth date of Ramses II. Whether the same is true of Hatshepsut we do not at yet know. The winter solstitial penetration occurs around 06.35 over five days and given a clear sky, provides ample opportunity to experience the magic of this phenomenon.

Ipet-Isut

The great temple of Amun-Ra poses some intriguing questions. By coincidence we can today experience the amazing phenomenon of the rise of the mid-winter sun creating a brilliant light show along the central axis of the temple. This can be observed from the first open court right through to the Middle Kingdom court to the west of the barque shrine. This is because of the partial collapse of the rear wall of the Hatshepsut's temple of '*Amun who hears our prayers*', which stands to the east of Tuthmosis III's Akh-menu.

It is clear that the temple was aligned from its earliest foundation to the mid-winter solstice but how this phenomenon was woven into the temple architecture and ritual is far from clear. The earliest known parts of the temple date from the reign of Sesostri I but whether any aspect of his temple faced east, or was open to the east, is uncertain. We know that the present barque shrine of Philip-Arrhidaeus has two entrances, as did one of its predecessors, the beautiful '*La Chapelle Rouge*' of Queen Hatshepsut. If there was a clear view through to the eastern horizon the light of the solstitial sun could have flooded the shrine at dawn by opening the eastern doors. This might be the reason why this shrine, unlike any other that I have seen in Egypt, has doors at both ends.

However, if this was the case, why did Hatshepsut erect her small temple of '*Amun who hears our prayers*' which would have blocked this solstitial light penetration? It is possible that there was an intention of obstructing the alignment for a period of ten or so days on either side of the solstice thereby creating a period of darkness before the return of Amun-Ra to his shrine, and during that time the principle focus would have been on Hatshepsut's eastern temple.

What is clear is that this stasis did not remain for long because first Tuthmosis III erected the Akh-Menu across the line of the temple axis and later Tuthmosis IV, erected the huge 36m high '*Lateran*' obelisk, on the temple axis just in front of Hatshepsut's eastern temple. This would have effectively blocked all solar light penetration into the barque shrine, as well as along the main temple corridor, for a considerable period of time on either side of the solstice. It would only have been after the equinoxes, during the summer months, when the height of the sun would clear the top of the obelisk. We do not know why Tuthmosis IV and his priesthood chose to block this alignment, perhaps this was done to emphasise the twin polarity of Amun '*the hidden one*' and Amun-Ra the solar god.

Despite the blocking of the alignment on the central axis of the temple observations of the solstice could still have taken place from other areas of the temple, such as Tuthmosis III's '*High Room of the Sun*' in the Akh-menu, or from the main roof of the temple.

Summary

The central axis of the temples of Ipet-Isut and Djoser-Djeseru are two examples where solar light penetration was used at specific times of the year. There are many other temples in Egypt aligned to the mid-winter solstice, as well as to the 'Plough Stars' (*Meskhetyu*) and to Sirius (*Sopdet*). The subtleties on the way sunlight or starlight was used in temple constructing and ritual is only just becoming clear to us and opens up a potentially extensive area of research.

ⁱ M. Shaltout and J. A. Belmonte, *On the orientation of ancient Egyptian temples: (1) Upper Egypt and Lower Nubia* (Journal for the History of Astronomy, xxxvi no. 124 2005), 273-298; J. A. Belmonte and M. Shaltout, *On the orientation of ancient Egyptian temples: (2) New experiments at the oases of the Western Desert* (Journal for the History of Astronomy, xxxvii no. 127 2006), 173-198; M. Shaltout, J. A. Belmonte and M. Fekri, *On the orientation of ancient Egyptian temples: (3) Key points in Lower Egypt and Siwa Oasis* (Journal for the History of Astronomy, xxxviii no. 131 2007), 413-442; M. Shaltout, J. A. Belmonte and M. Fekri, *On the orientation of ancient Egyptian temples: (4) Epilogue in Serabit El Khadem and Overview* (Journal for the History of Astronomy, xxxix no. 135 2008), 181-211.