Lunar Extremes, Lunar Cycles and the Minor Standstill

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Introduction: Extremes and Minor Standstill

A lunar standstill, also named a lunistice in resonance of the solar ‘solstice’ (the Sun standing still), is the moment of the lunar month when the Moon is seen farthest north or south with respect to other positions of that particular swinging motion from a given position on Earth. As Lionel Sims indicates in his paper, these extremes are not completely fixed, due to the receding motion of the line of nodes, and thus, the extremes vary between a major and a minor extreme in an 18.6-year period (or 9.3 years if we take the period between a major and a minor extreme).

Although it has been named “lunar standstill”, Sims argues that it is not a true standstill as, in contrast with the solstice, the Moon is never to be found in that extreme for a long period of time. However, I would like to advocate otherwise. It is true that it cannot be compared with the period of stillness of the Sun in absolute terms (let us take Sims’ definition of 11 days as a practical number for the sake of clarity). However, 11 days in 365 amounts to just about 3% of the year when we are going to find the Sun near one of its extremes (6% if we consider both of them).

This is in contrast with the Moon, which can be found near a given extreme for nearly two days (in some cases, three), or four days if we take both extremes north and south. This amounts to nearly 15% of the time in a tropical month. Clearly, it is easier to find the Moon near its extremes than the Sun!

This is exemplified in Figure 1. There we can see in light grey all the observable setting positions of the Moon for the two years of the major standstill (calculated for the period between April 2005 and March 2007 for the latitude of Stonehenge). It is clear that the two maxima near the extreme positions indicate that such locations are accumulation points in the lunar setting positions. From this diagram, it is three times more likely to find the Moon near the extreme than in between.
The dark grey surface in Figure 1 indicates the distribution of all setting Moons (in any phase) observable in the minor standstill (calculated from April 2014 until March 2016). The number of observable setting Moons is very similar and thus, the numbers are comparable. It is clear that the distribution now is narrower in azimuth and, at the same time, the relative frequency of the extremes is larger in the minor standstill than in the major standstill.

This is so because, in the minor standstill, the range of available azimuths is narrower while the tropical month lasts for the same amount of days – i.e. we have the same number of setting Moons but seen in a narrower space, so it is easier to have more setting positions close to the extreme settings.

![Figure 1](image.jpg)

**FIGURE 1.** Distributions of the visible setting Moons in the major (light grey) and minor (dark grey) standstill as seen from Stonehenge. The two distributions include a similar number of Moons. The short vertical dotted line indicates the solstices, and the long dashed line indicates west. For further information, see text.

In other words, the major lunar standstill sets clear outer limits for the positions of the Moon while the minor standstill stands out as the position from which it is more likely to observe the Moon. This, in its own right, provides the minor lunar standstill with a characteristic of its own, without any reference to the Sun whatsoever. I will discuss the implications of this further on.

**A matter of cycles and visibility**

Sims, following Morrison and others, argues that in each nodal cycle, the winter solstice at a minor standstill is followed within a small number of days by a dark Moon. Thus, the small window visible on top of the lintels of Stonehenge, formed by the large Trilithon, should frame such a dark Moon, within the duration of the winter solstice period of visibility of the setting Sun in the lower part of the structure.
Leaving aside the fact that the upper window should also frame the setting Sun a few weeks before and after the winter solstice, two problems arise here, in my view:

a. the differences in the lengths of the nodal and the Metonic cycles; and
b. the observability of such setting event.

Let us start with the first problem. The Metonic cycle means that every 235 synodic months the same Moon (the same lunar phase) will be seen on the same day of the tropical solar year. Every 19 tropical years the lunar phases repeat themselves on the same days. However, the nodal cycle is 18.6 years long. The discrepancy is 0.4 tropical years, but, of course, on the year that the nodal cycle ends, the Moon next to the winter solstice would be the same as the one 19 years before. However, the two cycles are different and thus, with time, they would be out of phase. Figure 2 illustrates these cycles. Each bar is a lunar cycle of either 19 (dark grey) or 18.6 (light grey) years.

![Figure 2. Relative shifting of the Metonic cycle with respect to the nodal cycle. The Metonic cycle is indicated by the dark shaded bars, while the nodal cycle is indicated by the light shaded bars. Each nodal cycle in the figure is supposed to start at the end of the previous cycle; this is why each light grey bar is shorter as we move upwards. Vertical dashed lines indicate the last three tropical years for each Metonic cycle. The top scale is given in synodic months. For details, see text.](image)

From this figure, it is apparent that, for the two first cycles, the system holds and the last year of the cycle repeats the Moon of the previous 19-year cycle. However, after three cycles, the nodal cycle is out of step by 1.2 years with respect to the first Metonic cycle of reference. This implies that, for that year, the Moon next to the winter solstice (WS) would be like the one 18, and not 19, years before. If the particular Moon following the WS from the first cycle was a dark Moon, now it would occur either ten days before or 19 after WS, clearly contradicting the possibility of having been watched through the visibility window defined by Sims.

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In other words, every three nodal cycles, it would recede by one year in the Metonic cycle, implying offsets of \((10, 21, 3, 14, 25, 6, 17, 28, 9, 19, 1, 12, 23, 4, 16, 26, 7, 18)\) days ahead of astronomical winter solstice or \((19, 9, 26, 16, 4, 23, 12, 2, 21, 10, 28, 17, 6, 25, 13, 3, 22, 12)\) days after astronomical winter solstice. Even if we allow for a generous offset of 11 days ahead or after winter solstice, there would be cycles during which such a scheme would be broken (indicated by an underscore in the list above). This, in my view, poses a severe problem to the idea that a simultaneous (meaning within 11 days of WS) sighting of the winter solstice and the minor standstill dark Moon was the aim of that particular arrangement of Stonehenge.

It is true, however, that if we consider the period of standstill to last for nearly two years then, in at least one of the two years, there will be one year when the condition advocated by Sims is fulfilled.

The previous caveat would not deny the possibility that the upper window was designed to spot the Moon on minor standstill years, though. However, here the problem is different and would be related to problem (b), the observability of such an event. According to Sims, in such a year one could see the reversal of the synodic cycle of the Moon happening in the 13 Moons observable from the Heel Stone towards the upper window. However, there is a problem here, as not all phases would be visible at the setting, by definition. In particular, if we compute the standstill Moons from November 2014 until December 2015, taking into account, as stated above, that the lunar standstill lasts for two or three days (in all cases considered, the declination of the Moon changes by less than 1°), we obtain the list displayed in Table 1.

### Table 1. Standstill Moons for the period between November 2014 and December 2015. The columns indicate the month, the days when the Moon appears to be close to the standstill position (with less than 1° of variation), the elongation for those days and if the setting would be visible (Y) or not (N), or there is a new/dark Moon (D).

<table>
<thead>
<tr>
<th>Month</th>
<th>Days</th>
<th>Elongation (°)</th>
<th>Visible (Y = yes; N = no; D = dark Moon)</th>
</tr>
</thead>
<tbody>
<tr>
<td>November 2014</td>
<td>23, 24, 25</td>
<td>15, 29, 42</td>
<td>Y, Y, Y</td>
</tr>
<tr>
<td>December 2014</td>
<td>20, 21, 22</td>
<td>-19, -7, 10</td>
<td>N, N, D</td>
</tr>
<tr>
<td>January</td>
<td>17, 18, 19</td>
<td>-40, -26, -13</td>
<td>N, N, N</td>
</tr>
<tr>
<td>February</td>
<td>13, 14, 15</td>
<td>-74, -61, -46</td>
<td>N, N, N</td>
</tr>
<tr>
<td>March</td>
<td>13, 14, 15</td>
<td>-93, -81, -65</td>
<td>N, N, N</td>
</tr>
<tr>
<td>April</td>
<td>9, 10, 11</td>
<td>-124, -112, -99</td>
<td>N, N, N</td>
</tr>
<tr>
<td>May</td>
<td>6, 7, 8</td>
<td>-154, -142, -129</td>
<td>Y, Y, Y</td>
</tr>
<tr>
<td>June</td>
<td>3, 4, 5</td>
<td>-172, -159, -146</td>
<td>Y, Y, Y</td>
</tr>
<tr>
<td>July</td>
<td>30, 1, 2</td>
<td>154, 167, -175</td>
<td>Y, Y, Y</td>
</tr>
<tr>
<td>July</td>
<td>28, 29, 30</td>
<td>135, 148, 162</td>
<td>Y, Y, Y</td>
</tr>
<tr>
<td>August</td>
<td>24, 25, 26</td>
<td>103, 116, 129</td>
<td>Y, Y, Y</td>
</tr>
<tr>
<td>September</td>
<td>20, 21</td>
<td>84, 97</td>
<td>Y, Y</td>
</tr>
<tr>
<td>October</td>
<td>17, 18, 19</td>
<td>54, 66, 78</td>
<td>Y, Y, Y</td>
</tr>
<tr>
<td>November</td>
<td>13, 14, 15</td>
<td>23, 35, 47</td>
<td>Y, Y, Y</td>
</tr>
<tr>
<td>December</td>
<td>11, 12, 13</td>
<td>5, 16, 28</td>
<td>D, Y(?), Y</td>
</tr>
</tbody>
</table>
So, out of the 15 Moons considered here, five are not visible at moonset, because they set when the Sun is high on the horizon, rendering the Moon invisible.

**Implications**

Simplifying to the extreme, Sims indicates that the fact that there exist groups of megalithic monuments in NW Europe where there are both solar orientations – possibly related to winter solstice sunrise or sunset – and lunar – possibly related to the standstill – shows a tendency to replace a previously lunar cult with a new solar ritual. However, this hypothesis, although it could prove to be elucidating and insightful, is far from being well-rooted in any strong astronomical or archaeoastronomical evidence. Despite the fact that there are indeed groups of monuments with clear lunar orientations, like the Recumbent Stone Circles of northeast Scotland for instance (Ruggles 1999), a naïve interpretation of the scheme proposed by Sims would imply that these RSCs would be among the earliest monuments in a sequence from purely lunar towards purely solar orientations with shades of grey in between both extremes. However, the chronologies of these monuments do not place them among the most ancient in the area.

On the contrary, it seems that the earlier groups of monuments present less defined orientations, perhaps indicative of a mixture of both solar and lunar orientations (see e.g. Prendergast 2011 for the Irish passage tombs), and that, later on, other groups appear to be more defined towards a solar or lunar preference, perhaps indicating a difference in the preeminence of the celestial bodies associated with the rituals that might have taken place in those areas.

Another problem is the question of whether this scheme (lunar towards solar replacement) is true, and Sims argues above that “all the world’s cosmologies and religions are transformations of an original lunar scheduled cultural template”. However, this seems rather difficult to prove, even more so for the megalithic rituals.

Let us consider the oldest megalithic monuments found to date, the stone circles and ovals of Göbekli Tepe in southern Turkey. Dated to 9000 BC, an epoch when agriculture and, perhaps, domestication were still an experiment, the towering pillars of this *tell* (mound) in the plains of southeast Turkey are filled with carved figures (Schmidt 1998, 2010). The T-shaped pillars are placed to form oval arrangements, with several couples of pillars at the inside of such formation. The excavators argue that the ovals were most probably unroofed, but with an entrance in all cases. In the summer of 2009, the author visited the site as part of an expedition to measure the orientation of a number of monuments in Turkey and we could not find any coherent alignment, especially when considering the local landscape that precluded any orientation towards winter solstice (Belmonte and Gonzalez-Garcia 2015). Recently, it has been argued that a number of the structures could be related to different star-rising events (either to Sirius [Magli 2013] or Deneb [Collins 2009; De Lorenzis and Orofino 2015]). However, these accounts must be taken with great caution. For example, the claims that the monuments are oriented towards north, and thus towards Deneb, could be misinterpreting the local topography that hinders a clear view of this part of the horizon. In fact, it seems more interesting that one of the oval structures is oriented towards summer solstice sunrise (on top of
the distant Karaca Dag, the most conspicuous mountain in the horizon of Göbekli, while another is oriented towards the southernmost rising of the Moon (see Figure 3).

![Göbekli Tepe in southeast Turkey. Top: The site encloses the oldest megalithic structures found to date. The orthostats were arranged in oval structures and later buried. Note the closed horizon towards north, to the right in the picture. Bottom: Orientation diagram for the seven structures of Göbekli measured so far. The labels outside the circle indicate the cardinal directions and the sunrise or sunset positions for the summer (SS) and winter (WS) solstices. The orientations are indicated inside the circle as short solid lines (Image by A.C. González-García).](image)

**FIGURE 3.** Göbekli Tepe in southeast Turkey. Top: The site encloses the oldest megalithic structures found to date. The orthostats were arranged in oval structures and later buried. Note the closed horizon towards north, to the right in the picture. Bottom: Orientation diagram for the seven structures of Göbekli measured so far. The labels outside the circle indicate the cardinal directions and the sunrise or sunset positions for the summer (SS) and winter (WS) solstices. The orientations are indicated inside the circle as short solid lines (Image by A.C. González-García).

This last fact seems to put into play the scheme proposed by Sims; however, the picture is far from being a simple one of the substitution of one cult with another. Rather, it seems more likely that two or more cults were already in place at this early moment in time. Finally, it must be remembered that Göbekli is a *unicum*, and thus, no firm conclusion can be obtained from its study yet.
Now, let me very briefly consider other areas with megalithic monuments across continental Europe, in particular southern France and the Iberian Peninsula.

France displays a wide range of different orientations in several groups of monuments (leaving Brittany aside, because of its complicated nature). In some cases, they could be more solar than lunar, though others look different and, finally, others seem a mixture (González-García 2015). The biggest problem here would be the lack of reliable chronological sequences that hamper the applicability of Sims’ scheme. However, those cases where a definite lunar orientation has been claimed (like the Bouches-du-Rhône or Languedoc type dolmens in southern France, see González-García 2015) appear to be rather late in megalithic France, again contrary to what would be expected in Sims’ frame.

The Iberian Peninsula displays a wide variety of orientations, ranging from mostly easterly orientation in the Atlantic façade (from Galicia to Southern Portugal), that might in some cases be related to solar orientations (Galicia) and, in others, to lunar ones (Alentejo), although the issue is far from settled here either (e.g. Da Silva 2004; González-García and Belmonte 2010; Silva and Pimenta 2012; see also Silva 2014 for possible stellar orientations).

Conclusions

Sims’ scheme of lunar-solar conflation or substitution could be a valid and insightful idea, based on plausible anthropological arguments, but I fear that the evidence is, as yet, weak. To be fair, I find that the problem is mostly in the dating of the monuments rather than in the theoretical scheme, although, in my view, the latter should be somehow modified, given the astronomical problems posed above.

The lunar minor standstill appears as an important moment in the lunar cycle since, for a period of two years, it is the area where it is most likely to find the Moon. Even if we consider the whole nodal period, this area of the horizon is where the Moon spends more time, and thus indicates that if one is going to follow the Moon, it appears more natural that the location with the most probable or more repeated orientations is the one to be chosen first.

However, this does not imply, in my view, a reading where a substitution of a lunar by a solar cult emerges.

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References


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