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STANDING AND SITTING GODS IN MUL.APIN

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Abstract: In 2018 Hoffmann and Krebernik proposed a new reading of the lines MUL.APIN I i 23 as rubric markers, implying that the "Standing and Sitting Gods of the Ekur" are terms referring to two groups of asterisms in the previous lines. Astronomically, this division refers to the ever-visible circle versus the rising and setting constellations in the path of Enlil. Based upon Horowitz's suggestion that this is also a celestial representation of the presentation scene from Mesopotamian art (N.A.B.U. no.3, 2023), I re-analysed the astronomical meaning of the constellations in the Path of Enlil in MUL.APIN and found an agricultural calendar in the path of Enlil. This finding puts the indigenous Mesopotamian set of constellations in line with other indigenous astronomies that have been found by anthropological and cultural studies all over the world.

Keywords: Babylonian Astronomy, Middle Babylonian, MUL.APIN, Standing Gods, seasons

1 INTRODUCTION

MUL.APIN is the oldest known compendium of astronomical knowledge. It is written in cuneiform and usually dated before or about 1000 BCE (Hunger and Steele, 2019: 16–19) although parts of the compilation may predate the compilation by several centuries as the data in the lists of heliacal risings (and settings) seem to place the observations between 1400 and 1100 BCE (de Jong, 2007; Schaefer, 2007). Watson and Horowitz (2011: 127) concluded from the increasing text coherence and complexity throughout the lists of the compendium that the compiled lists may originate from different epochs, the first lists being older than the last ones in the collection of MUL.APIN (but without an intentional specific sequence in age).

The compendium is usually divided in two fundamental sections, the first one containing data to describe the positions of stars and constellations relative to each other, the second part rather focusing on all sorts of variabilities, e.g. the length of the noon shadows and the duration of night/ daylight over the course of the year, the motion of planets, several observations to judge the necessity of intercalations of the calendar, and of course sets of omens. In this paper, we will only deal with the first of all lists in this compilation of 14 lists. The first list, commonly called 'star catalogue', is actually a catalogue of asterisms (that may or may not be stars, but in most cases will be constellations) and their associated deities. The text genre of this section is an explanatory list that associates each asterism with a deity (Hoffmann and Krebernik, 2023).

Furthermore, Hoffmann and Krebernik (2023) suggested a new reading of line I i 23 of MUL.APIN as rubric markers. Prior to this, the line has been read as a (rather strange) entry for one or two constellations, but it did not fit this schema, and the identification of these two constellations has always been regarded as controversial.

The Path of Enlil has 33 asterisms (I i39). Reading line I i23 as a rubric marker, divides the first two thirds of the "Path of Enlil" in the northern half of the Northern Hemisphere of the Babylonian uranology into two parts: the rising and setting constellations in the northeastern/ northwestern part of the horizon, and the ever-visible constellations (cf. Table 1). This astronomical implication of a grammatical feature connects MUL.APIN to the (later) traditions of star catalogues and uranologies in Greek language that typically start with the circumpolar area and continue from there southwards. MUL.APIN would then also have this division but start with the rising and setting northern asterisms and continue with the circumpolar ones. The immediate reaction by Wayne Horowitz when he heard about this idea at a conference was the comparison with the so-called presentation scene that is frequently depicted in Mesopotamian art (Hoffmann and Horowitz, 2023).

These two new readings (cf. Table 1), a division of the northern part of the uranology in MUL.APIN and their divine interpretation as a presentation scene, call for a new meticulous investigation of the first list in MUL.APIN: How exactly are the deities arranged in the sky? What deities are chosen at what dates of the year, and what or who do they represent? Do the two new readings (and their possible implications) still make sense in a broader astronomical context?

Based upon this discussion and the background in cultural astronomy (as defined e.g. by Ruggles and Chadburn, 2024: 186–187), in this paper I will discuss the implications of these findings for our understanding of Mesopotamian astronomy in the second millennium.

Table 1: The text of MUL.APIN with rubric markers in the 'Path of Enlil' (after Hoffmann and Krebernik, 2023).

our number	DIŠ	explanandum	explanans
1	1	^{STAR}*EPINNU* (Plough)	^{GOD}Enlil
2	1	^{STAR}*BARBARU* (Wolf)	seeder of ^{STAR}*EPINNU*
3	1	^{STAR}*ŠIBU* (Old Man)	^{GOD}Enmešarra
4	<1>	^{STAR}*GAMLU* (Throwing-stick)	^{GOD}Gamlum (Throwing-stick)
5–6	1	^{STAR}*TÚ'AMÚ·RABÛTU* (Great Twins)	^{GOD}Lugalirra and ^{GOD}Meslamta'ea
7–8	1	^{STAR}*TÚ'AMÚ·ṢEḪRÛTU* (Little Twins)	^{GOD}Alammuš and ^{GOD}Ningublaga
9	1	^{STAR}*ALLUTTU* (Crab)	seat of ^{GOD}Anu
10	1	^{STAR}*URGULÛ* (Lion)	^{GOD}Latarak
11	1	STAR opposite ^{STAR}*URGULÛ*	STAR (of the) King
12	1	twinkling STARs in the tail of ^{STAR}*URGULÛ*	'date-palm spadix' (jewellery?) (of) ^{GOD}Erua | ^{GOD}Zarpanitum
13	1	^{STAR}ŠU.PA (The Bright?)	^{GOD}Enlil who determines the destinies of the land
14	1	STAR in front of it	^{STAR}*ḪENGALLĀYU* (Abundant) | vizier of ^{GOD}Ninlil
15	1	STAR behind it	^{STAR}*BĀŠTUM* (Dignity) | vizier of ^{GOD}Tišpak(<*INANNA!?)
16	1	^{STAR}*EREQQU* (Wagon)	^{GOD}Ninlil
17	1	STAR by the pole of ^{STAR}*EREQQU*	^{STAR}*ŠĒLEBU* (Fox) | ^{GOD}Erra, the strong of the gods
18	1	STAR on the forehead of ^{STAR}*EREQQU*	^{STAR}*LAḪRU* (Ewe) | ^{GOD}Aya
19	1	^{STAR}MU.BU.KÉŠ.DA (Hitched yoke?)	^{GOD}*Anu-rabû* of heaven
20	1	^{STAR}MAR.GÍD.DA.AN.NA (Wagon of heaven)	^{GOD}Damkianna
21	1	STAR in its bond	^{STAR}*APIL-EMAḪ* (Heir of the Emaḫ-temple) | foremost son of ^{GOD}Anu
	{1}	STAR·STANDING·GOD^{S} of the Ekur	The stars (of the) Standing Gods of the Ekur
	({1})	STAR·SITTING·GOD^{S} of the Ekur	Sitting Gods of the Ekur (temple)
22	1	^{STAR}*ENZU* (She-Goat)	^{GOD}Gula
23	1	STAR in front of ^{STAR}*ENZU*	^{STAR}*KALBU* (Dog) (of ^{GOD}Gula)
24	1	bright STAR of ^{STAR}*ENZU*	^{GOD}Lamassatu | vizier of ^{GOD}Baba (= ^{GOD}Gu-la)
25–26	1	2 STAR^{S} behind it	^{GOD}Nin-SAR and ^{GOD}Errakal
27	1	^{STAR}U_4.KA.DU_8.A	^{GOD}U.GUR (Nergal)
28	1	STAR to the right of it	^{STAR}*ŠAḪÛ* (Pig) | ^{GOD}Damu
29	1	STAR to the left of it	^{STARS}*SISÛ* (Horse)
30	1	STAR behind it	^{STAR}*LULIMMU* | vizier of STAR.STAR (Pleiades)
31	1	twinkling STAR^{S} opposite ^{STAR}*LULIMMU* (Stag)	^{GOD}Ḫarriru (Field Mouse) | ^{GOD}Manzât (Rainbow)
32	1	red bright STAR in the kidney of ^{STAR}*LULIMMU*	^{STAR}*PĀŠITTU* (Deleter)
		When the STAR^{S} of ^{GOD}Enlil are completed:	
33	1	big STAR, its 'heat' is dark, it divides the sky and stands	STAR (of) ^{GOD}Marduk | ^{GOD}Neberu (Ford/ Ferry)
	1	^{STAR}SAG.ME.GAR (Jupiter), it changes its place and crosses the sky	
		33 STAR^{S} of ^{GOD}Enlil	

Standing Gods setting asterisms

Sitting Gods never-setting asterisms

rubric markers

rubric marker

rubric marker

For ease of reading, I refer to the individual lists in MUL.APIN, which are shown below in Table 2.

2 RE-ANALYSIS OF THE STANDING AND SITTING GODS IN MUL.APIN

The method in this paper is strictly bound to MUL.APIN, re-analyzing the text. I use the text reconstruction presented in the standard edition by Hunger and Steele (2019), rewrite it in modern text layout, and compare the order of asterisms in different lists of this compendium (which may have different origins).

2.1 Standing Gods in the First, Third and Fifth List of MUL.APIN

2.1.1 Occurrences of Standing Gods in MUL.APIN

The term 'Sitting Gods' never re-occurs in MUL.APIN but the term 'Standing Gods' can be found in the list of simultaneous risings and settings (List I3), and in the list of *ziqpu*-asterisms (List I5).

2.1.1.1 Standing Gods in List I5

The list of *ziqpu*-asterisms (I5) falls in two parts (I5a and I5b). The first section (I5a) in lines I iv4-6 simply lists a sequence of asterisms while the second part (I5b, I iv13-30) presents *ziqpu*-asterisms 'in the middle of the sky' while some other asterisms are observed rising. Thus, List I5b aligns with the schemata of Lists I2-4 while List I5a resembles the much simpler style of the catalogue in List I1. As the two lists I5 do not completely overlap and the rhetorics in I5b is much more complex, we suspect with Watson and Horowitz (2011) that they have different origins and compare only I5a with I1 because of the apparent similarities.

The sequence of nine asterisms, "The Old Man, The Crook, The Great Twins, The Crab, The Lion, Erua's asterism, The Abundant One, ŠU.PA, Dignity", is given in both lists. Yet, in the first list, The Crab is accompanied by the Lesser Twins, and the Old Man is preceded by The Plough (Table 3).

In contrast, the fifth list has five asterisms between Dignity and The Old Man, all of them

Table 2: Nomenclature for the lists on Tablet/Unit I.

List I1	I i 1	to	I ii 35	Catalog of asterisms (inventory of the sky)
List I2	I ii 36	to	I iii 12	Dates of heliacal rises in the Babylonian calendar
List I3	I iii 13	to	I iii 33	Simultaneous risings and settings
List I4	I iii 34	to	I iii 48	Time intervals between heliacal risings
List I5	I iv 1	to	I iv 30	*Ziqpu*-asterisms
List I6	I iv 31	to	I iv 39	Asterisms in the path of the Moon

Table 3: Comparison of order of asterisms in the sky as given in the lists of MUL.APIN.

My Numbers	Order of in the sky as described		
	List I1 (I i1–14)		List I5 (I iv4–6)
1	Plough with "Wolf"		
2	Old Man	10	ŠU.PA
3	Crook (Throwing-stick)	11	Dignity
4	Great Twins		Standing Gods, Dog, She-Goat, U_4.KA.DU_8.A, Stag
5	Little Twins	2	Old Man
6	Crab	3	Crook
7	Lion with "King"	4	Great Twins
8	Erua's star cluster	6	Crab
9	Abundant One (in front of ŠU.PA)	7	Lion
10	ŠU.PA	8	Eru
11	Dignity (behind ŠU.PA)	9	Abundant One

being absent in the first list (Table 3). Interestingly, one of them is the asterism of the Standing Gods, so the author of the list of *ziqpu* asterisms considered the term "The Standing Gods" as a name of an asterism while the author of the inventory of the sky used the term "The Standing Gods of the Ekur" as paratext, namely a rubric marker summarizing a group of northern asterisms.

Hoffmann and Krebernik (2023) compared the order of terms in List I1 and List I5 with the conclusion that the Standing Gods are always mentioned before the super-constellation of goddess Gula and her Dog (located in the vicinity of the bright star Vega, cf. Hunger and Pingree, 1999: Appendix) but in List I1 the preceding asterisms are north of Vega and in List I5 the preceding asterisms are west of Vega (their Figure 2). Thus, the area of the Standing Gods in List I1 and List I5 is considered at different positions. Pointing out that the attribute "of the Ekur" is only appended in List I1, we therefore propose that The Standing Gods do not refer to the same asterism(s) as The Standing Gods of the Ekur. This hypothesis will be used and its implications explored in this paper (cf. Hoffmann and Horowitz, 2023).

2.1.1.2 Standing Gods in List I3

This list does not provide any dates but only asterisms on opposite sides of the horizon:

> I iii 27¶ Pabilsag, Zababa, and the Standing Gods rise, and
>
> I iii 28 the Arrow, the Bow, and the Crook set.

As Pabilsag is said to rise on the 15th of Month IX in I iii 5-6 (List I2), lines iii 27-28 in List I3 seem to claim the same for Zababa and the Standing Gods. Note that these Standing Gods are not the Standing Gods of the Ekur (List I1) but seem to refer to the same asterism as mentioned in List I5. The group of the Standing Gods of the Ekur from List I1 as proposed by Hoffmann and Horowitz (2023) would not rise at a specific day and together with a specific other constellation but over the course of half a year. Using the standard identification of these terms (cf. e.g. Hunger and Pingree, 1999: Appendix; and the dictionaries Gössmann, 1950; Kurtik, 2007), the half year of these risings would be the dry summer season. Mesopotamia has two seasons, the dry and the wet one, because it is dominated by the trade winds and monsoon effects in summer, and by the central Asian wind cell in winter. From Month XI to Month VI of the Babylonian calendar (from January/February to September in the modern calendar) is the dry season: The heliacal rising of the constellation ŠU.PA-Enlil is given in line I ii 46 as 15th day of Month VI. The heliacal rising of the Plough that is associated with the god of agriculture, Enlil, is not given but as the Old Man is reported to rise on the 15th day of Month XII in line I iii 12, the Plough must have risen a bit earlier, namely in Month XI: either together with the Field on the 5th (var. 15th) or with Anunitu on the 25th. The Standing Gods of the

Ekur rise heliacally after having been successively absent for a period of 30 to 70 days each within the period from Month XII to Month VI (as written in Lists I2 and I4).

2.1.2 Syntax of List I1 of MUL.APIN

Considering the first list as a lone case, the structure of the text suggests a division of the Path of Enlil in three parts: (1) The Sitting Gods of the Ekur in the circumpolar area, (2) The Standing Gods of the Ekur as a ring around them and both sections together forming The Ekur (cf. Hoffmann and Horowitz, 2023), and (3) some additional asterisms that are listed below (Table 1) the rubric marker(s) of the Standing and Sitting Gods of the Ekur. Considering these three groups individually, we can rearrange the list in a modern style with indents according to their reference to other terms/ constellations in the text of MUL.APIN list I1.

2.1.2.1 Sitting Gods of the Ekur

Sitting Gods of the Ekur: Lines I i15 to i22, we read as the gods sitting in the ever-visible circle. The English translation describes them as follows:

> I i15 The Wagon – Ninlil.
> I i16–17 The asterism which stands in the cart-pole of the Wagon: the Fox – Erra, the strong one among the gods.
> I i18 The asterism which stands in front of the Wagon: the Ewe – Aya.
> I i19 The Hitched Yoke – the Great Anu of Heaven.
> I i20 The Wagon of Heaven – Damkianna.
> I i21–22 The asterism which stands in its rope: the Heir of the Sublime Temple, the first-ranking son of Anu.

The asterisms of the Fox and the Ewe in lines I i 16–18 are not only given relative to the asterism of the Wagon (I i 15) but apparently even parts of it. The Wagon seems to be pulled by the sheep that goes in front (I i18). It might be a funny coincidence or intention that the Fox in the back makes the scene appear as a cosmic hunt (foxes chase sheep). Either way, the Fox and the Ewe are described as parts of the image (super-constellation) of the "Wagon with Fox and Ewe" which leads to a division of the circumpolar region in four constellations:

- Wagon – Ninlil (Enlil's wife)
  - Fox (Erra)
  - Ewe (Aya)
- Yoke – Anu
- Wagon of Heaven – Damkianna (Ea's wife)
- Heir of Emaḫ – Anu's Son (or Enlil's)

2.1.2.2 Standing Gods of the Ekur

Simílarly, we can arrange the asterisms of the Standing Gods of the Ekur according to their verbal descriptions in the text of MUL.APIN I i1–14. The list starts (lines I i1–2) with The Plough and its part, the seed-funnel, which is called The Wolf. Similarly, the asterism of The King (probably a single star-asterism) forms part of the constellation Urgula (The Lion, I i8) which is clearly written in the text: "… the asterism which stands in the breast of the Lion: the King." (I i9).

As stated above, the Lesser Twins only occur in list I1 and not in I5, which leads to the suspicion that they may be subordinate to another constellation. The identification proposals (cf. Gössmann, 1950: 104–105 and Kurtik 2007: 317–320) suggest we identify them either with the part of Gemini south of the ecliptic or with Canis Minor. If the first identification proves correct, the Lesser Twins and the Great Twins together form the constellation of the Twins (Gemini) in the Path of the Moon, and each of them can, therefore, be considered part of the constellation of the Twins, making them a (zodiacal) unit. If the Lesser Twins are identified with Canis Minor, i.e. the bright star Procyon and adjacent areas, they served as a substitute for The Crab in case of heliacal observations because The Crab consists of only faint stars (invisible in twilight) and Procyon rises simultaneously on the Mesopotamian horizon (Figure 1).

In any of these two cases, the Lesser Twins are strongly related to another constellation (either The Great Twins or The Crab) and we do not consider them to be independent. This transforms the list of the Standing Gods of the Ekur into the following:

1.	Plough + Wolf	– Enlil
2.	Old Man	– Enmeššarra
3.	Crook	– Gamlu(?)
4.	Great Twins	– Lugalirra, Meslamta'ea
5.	(Lesser Twins +) Crab	– Anu (his seat)
6.	Urgulû-Lion + The King	– Latarak
7.	Erua's asterism	– Erua
8.	Abundant One	– Ninlil (her vizier)
9.	ŠU.PA	– Enlil
10.	Dignity	– Tišpak (or Inanna[?])

This list of ten asterisms might lead to the idea that the underlying source for the composition of this fraction of MUL.APIN was a list of ten asterims as frequently found in astrolabe texts (cf. Horowitz 2014. Compiling many astrolabe texts he concluded that there had been ten sections before their number was adapted to the lunar year with its twelve lunations).

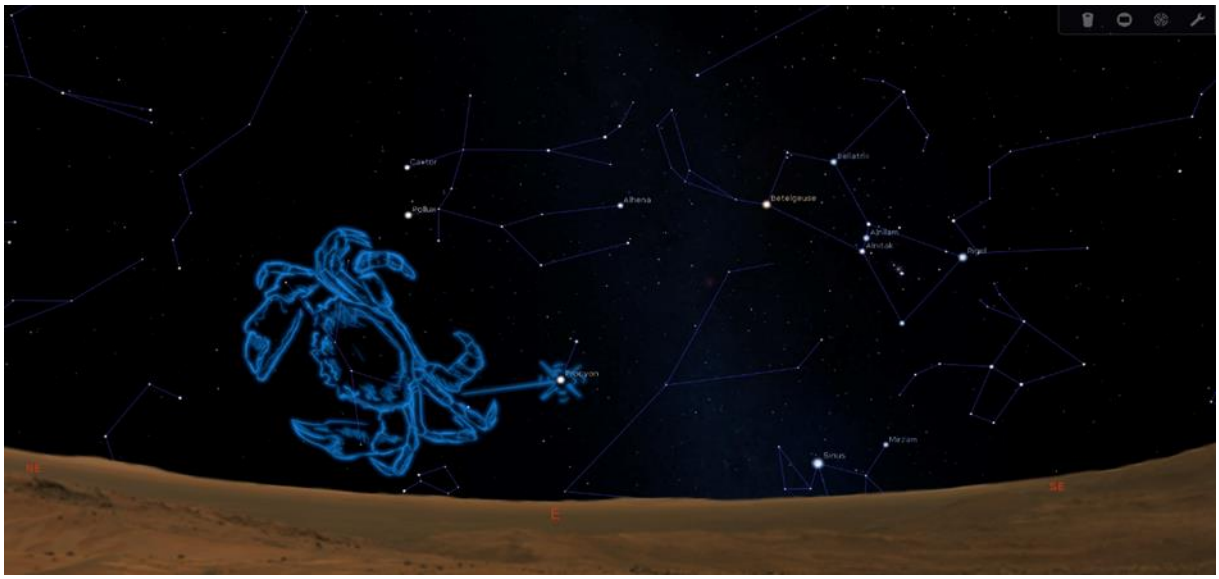

Figure 1: The constellation of the Crab and the bright star Procyon rising simultaneously above Mesopotamia in 1250 BCE (simulation with *Stellarium* and the graphic by R. Perdok, LWL Planetarium Münster, 2016).

Subsequently, the ten asterisms as grouped above from the text of MUL.APIN may be considered a division of the ring of the Standing Gods of the Ekur that encircles the circumpolar area. This would imply a division of The Ekur in MUL.APIN into the four super-constellations of the Sitting Gods and the ten super-constellations of Standing Gods. Subsequently, the question becomes: Where should we place the remaining asterisms in the Path of Enlil.

2.1.2.3 *The Rest of Enlil's Path*

Up to here, we have considered the asterisms and deities above the lines I i23 that Hoffmann and Krebernik (2023) suggested be read as rubric markers. In the next step, we will focus on the asterisms after this rubric marker. With the above schema of interpreting the explanatory list in MUL.APIN List I1 in indented layout, the rest of Enlil's path becomes a division into halves. The She-Goat and the U$_4$.KA.DU$_8$.A-demon are the main asterisms of this section, each having three subordinate asterisms and among these three, the last one is again split in parts. All other asterisms are related to the two main ones or are even parts of them:

- She-Goat
  - Dog in front of her
  - Bright star of the She-Goat
  - Double star behind She-Goat
    - (a double star necessarily
    - consists of two components)
- U$_4$.KA.DU$_8$.A-demon
  - Pig (right of him)
  - Horse (left of him)
  - Stag (behind him)
    - Field Mouse (part of Stag)
    - Deleter (part of Stag, its kidney)

2.1.2.4 *Concluded Hierarchy*.

Note that this section seems to be presented differently, and the structure of the text suggests a hierarchy of the three realms. The Gods of the Ekur, in this particular context, seem to be sorted according to their hierarchy:

(1) The inner circle has the main gods of the Babylonian pantheon in the second millennium, Ea, Enlil and Anu: the four sections are associated with Anu himself, the wives of Ea and Enlil, and the Heir of the Sublime Temple who might be a son of Enlil or Anu.

(2) The outer circle of the Standing Gods of the Ekur glorifies Enlil by dedicating two asterisms to him indirectly, one to his wife and one to his predecessor (Enmeššarra). In a heavenly presentation scene (Hoffmann and Horowitz 2023), Enlil and his Entourage are the Standing Gods of the Ekur, greeting his wife Ninlil and his father Anu, the Sitting Gods of the Ekur.

2.2 Astronomical Implications

2.2.1 Seats of the Gods

As pointed out by Hoffmann and Krebernik (2023), the seats of the gods in MUL.APIN's first list are always found above the path of the according god (see Figure 2): Anu's seat (Cancer) is in Enlil's Path, Ea's seat (Pegasus) is in Anu's Path. Enlil's seat is not explicitly mentioned in MUL.APIN but according to the scheme outlined here of (a) placing it above Enlil's Path (where he processes, walks and therefore does not sit) and (b) interpreting the Standing Gods of the Ekur as 'Enlil and his Entourage', the 'seat of Enlil' must be located

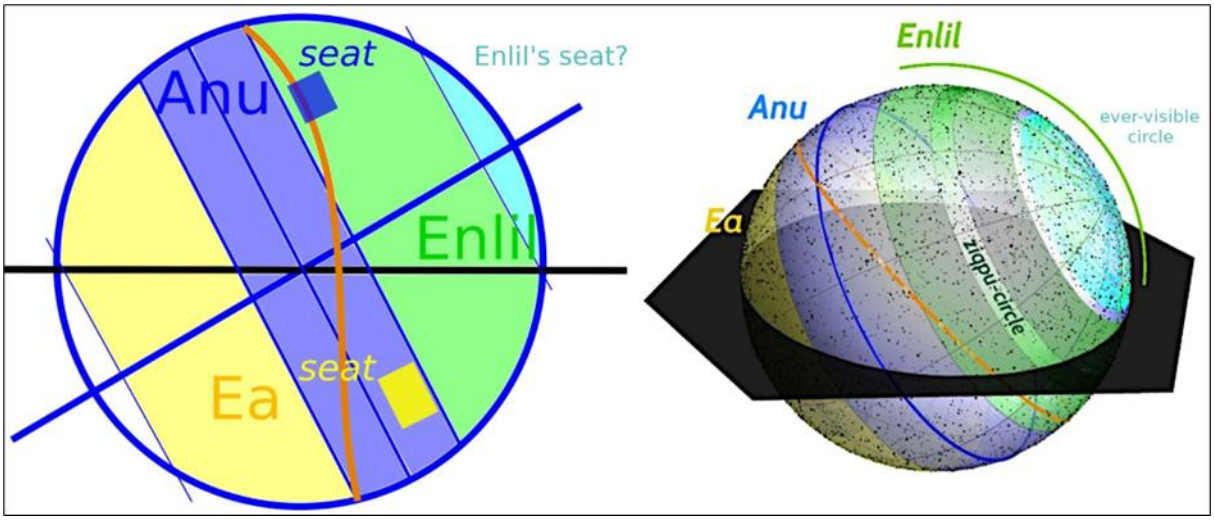

Figure 2: The seat of Ea (yellow box) is 'above' (north of) the Path of Ea in the Path of Anu, and the seat of Anu (blue box) is above Anu's Path in the Path of Enlil. Interpreting the circumpolar area as The Ekur, Enlil's seat must be there (after Hoffmann and Krebernik, 2023).

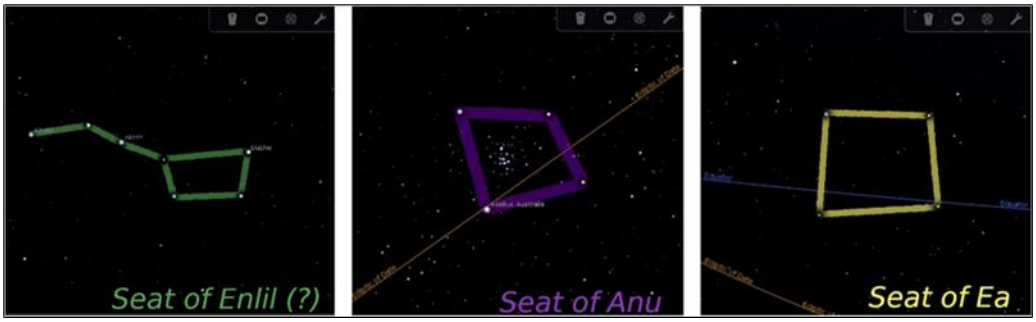

Figure 3: The seats of Anu and Ea are quadrilateral MUL patterns, so for the seat of Enlil we are looking for a quadrilateral among the asterisms of the Sitting Gods of the Ekur (original publication of these graphics in German in Hoffmann, 2021a).

within the Sitting Gods of the Ekur. As the seats of Ea and Anu are represented by quadrilateral star patterns, Hoffmann (2021a) suggests that the seat of Enlil might be the Big Dipper. This quadrilateral star pattern in the circumpolar area indeed belongs to the Sitting Gods of the Ekur as it is associated with Enlil's wife Ninlil (see Figure 3). The suggestion of this hypothetical missing seat still fits the new interpretation as a divine presentation scene.

2.2.2 Mapping the Path of Enlil

The syntax of the first part of the List I1, the Path of Enlil, suggests three units of its content: The Sitting Gods of the Ekur, the Standing Gods of the Ekur, and the asterisms outside The Ekur within the Path of Enlil. The identifications of these asterisms are known: the identifications of The Old Man (Per), The Crook (Aur), The Twins (Gem), The Crab (Cnc), Urgula (Leo), Erua's asterism (Com), The Abundant One + ŠU.PA (Boo), and Dignity (CrB) are long known: see Gössmann (1950) and Kurtik (2007). For the identification of The Plough, the literature suggests an extended area consisting of Cassiopeia, Andromeda and Triangulum but we argued for only Cassiopeia (Hoffmann and Horowitz, 2022). From late *ziqpu*-texts it is known that U_4.KA.DU_8.A has his feet in stars of Andromeda and Cepheus, his breast on Deneb (Alpha Cygni) and his head in the Cygnus-Sagitta area (cf. also Hunger and Pingree, 1999: Appendix, for these identifications). The con-stellation of the goddess Gula and her Dog are located in the area around the bright star Vega (cf. Gössmann, 1950; Hunger and Pingree, 1999: Appendix; Kurtik, 2007).

With regard to the celestial map, we only find two units: the ever-visible circumpolar asterisms as an inner circle and the asterisms that rise and set surrounding them (Figure 4). Mapped to the sky, the super-constellations of the "Goddess Gula and her Entourage" and the "U_4.KA.DU_8.A-demon and his Entourage" as derived from the syntax of the text, fill up the gap in the circle of the Standing Gods of the Ekur.

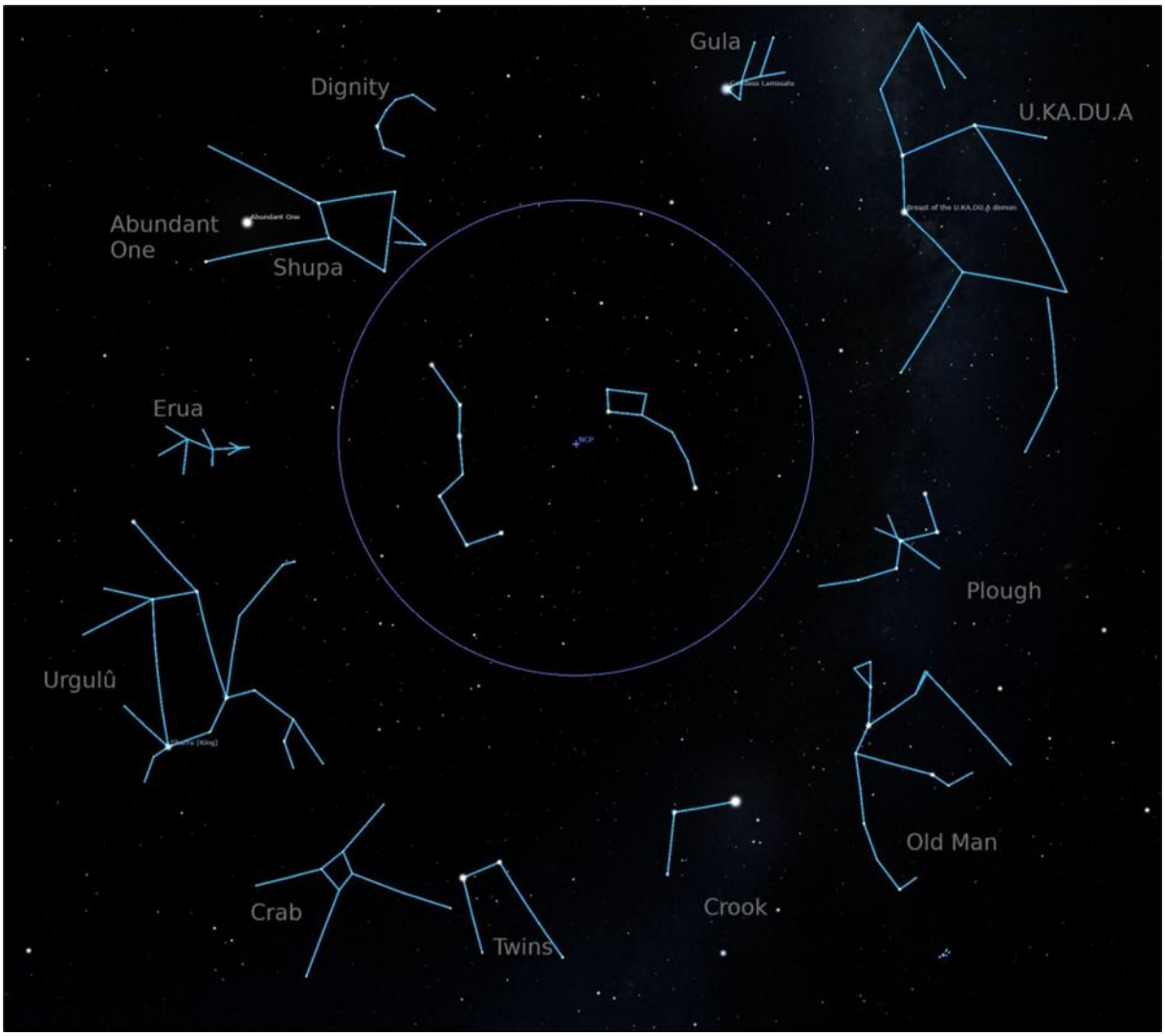

Figure 4: The asterisms mentioned in the Path of Enlil as mapped in *Stellarium* (documentation for the making of these constellations in the software are published in Hoffmann and Wolfschmidt (eds.) 2022, Appendix, cf. also Hoffmann, 2020 and Gullberg, Hoffmann, Gullberg, 2022).

Aligning the two super-constellations of Gula and U_4.KA.DU_8.A with the ten super-constellations of the Standing Gods of the Ekur leads to a list of twelve asterisms in the outer circle of Enlil's Path. This ring of twelve asterisms encircles the central Ekur where the Sitting Gods are seated. The central Ekur is divided in quarters, with Enlil's wife and Ea's wife seated in Wagons, Anu as the Heavenly Yoke, and the Heir of the Sublime Temple (as written in I i15, 19, 20, 21–22) who is normally considered a son of Enlil but here given as a son of Anu (cf. Krebernik's glossary in Hoffmann and Krebernik, 2023).

The division of the central Heavenly Ekur in quarters leads to the quarter of Anu (the Yoke, I i19) located in an area without bright stars but above the asterism of "The Seat of Anu" (I i7) in Cancer (cf. Figure 5, and for a depiction, Hoffmann, 2021b: 180). Still, the scheme depicted in Figure 6 does not exactly match the pattern in the sky as Gula and U_4.KA.DU_8.A are represented too small. Figure 5 shows clearly that the ten constellations of the Standing Gods of the Ekur from 'Enlil The Plough' to 'ŠU.PA Enlil' cover roughly two thirds of the circle, leaving almost a third circle for the two super-constellations of 'Gula and her Entourage' and 'U_4.KA.DU_8.A and his Entourage' (Figure 6).

The twelve parts of the division of the Path of Enlil are constellations (visible patterns of stars) of different sizes and definitely not of equal size like the abstract, not observable, schematic divisions of mathematical astronomy (e.g. the later division of the zodiac in twelve equal signs and the contemporary division of the celestial equator in twelve equal ideal months). The identifications are derived from the information in List I2, the list of heliacal risings.

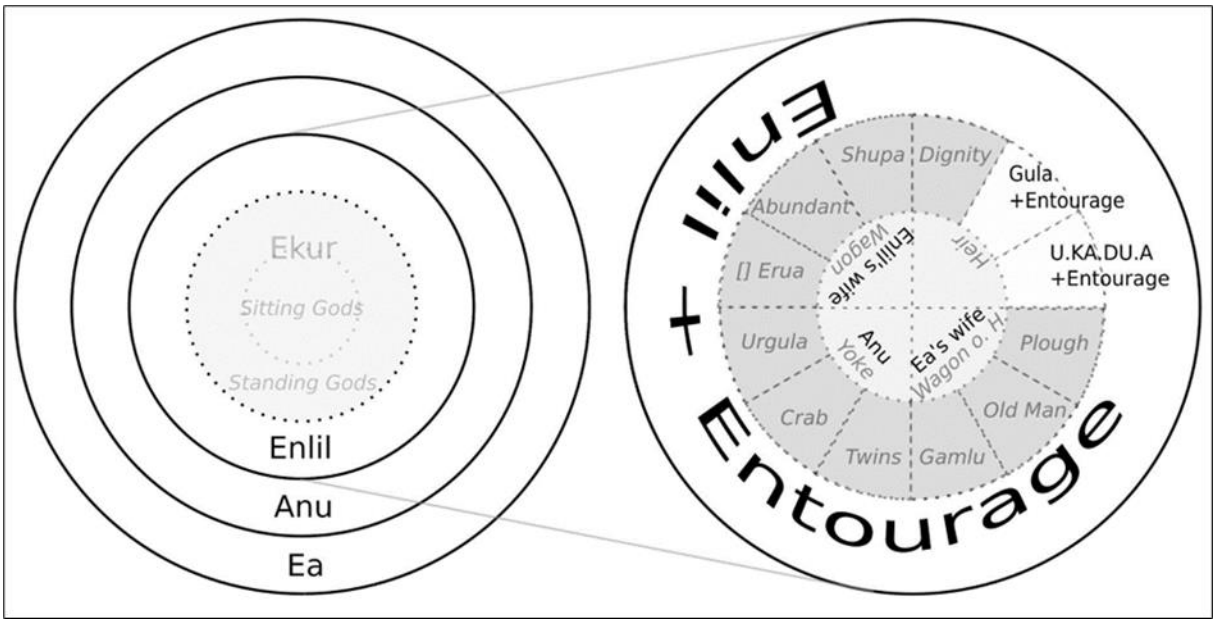

Figure 5: A scheme showing the Path of Enlil divided into twelve equal parts dedicated to Enlil himself, Gula and U_4.KA.DU_8.A. This sort of scheme might possibly have existed in ancient times, although a more accurate presentation of the scenario in the sky is given in Figure 6.

2.2.3 Data in MUL.APIN Second and Third List

A comparison of the data mentioned in the second list of MUL.APIN where rising dates are mentioned and the third list with the simultaneous risings and settings is incomplete at first glance but the period in the year when the Standing Gods of the Ekur rise (or are absent) can be derived from the preserved data (see Table 4).

The data provide the information that the Standing Gods of the Ekur are successively absent during the season of sesame farming.

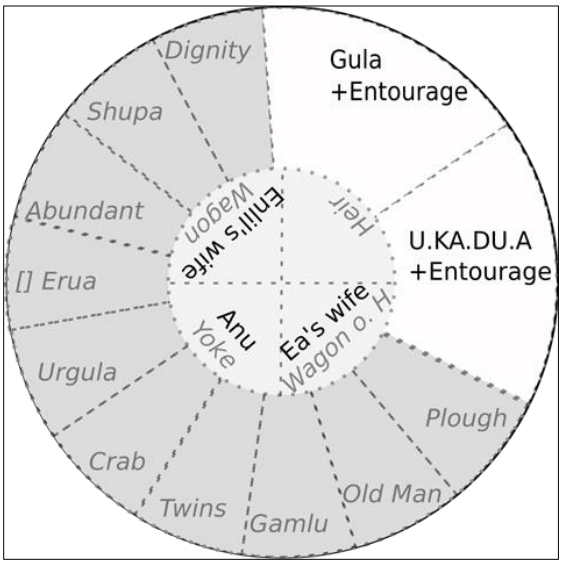

Figure 6: Schematic division of the sky into ten equal parts of the 'procession of asterisms of Enlil' covering 240° of the circle and the remaining 120° divided into Gula's and U_4.KA.DU_8.A's domains.

Thus, the dry season is the time of presentation when the Standing Gods of the Ekur vanish from human view in order to present to their deities. They are guided and guarded by Enlil who goes in the front of and at the end of this heavenly procession. A similar procession of animals and agricultural goods per seasons is found in many indigenous astronomies. Probably the best known is the procession of dark constellations in Inca astronomy (cf. Gullberg et al., 2020).

During the early winter season, the season of barley farming, the Standing Gods of the Ekur are visible until The Plough vanishes in the Sun's radiance, which coincides with the time of the barley harvest. The appearance of The Plough in late winter matches the time to prepare for the New Year's barley harvest.

The Plough is not mentioned in the second list of MUL.APIN but it can be established (with the aid of Stellarium) that it rises together with IKU (The Field) in Mesopotamia in the late second millennium (cf. Hoffmann and Horowitz, 2022; which is also confirmed by astrolabes). IKU rises at the beginning of Month XI according to MUL.APIN, about a month before The Old Man rises. This might have implied cultural activities by humans, for example, to get the fields ready by plowing in Month XI and seeding in Month XII, before the new year celebrations. After the invention of the seeder-plough these two steps were merged and may have been performed two weeks later.

Table 4: The times of the year when the asterisms of 'The Ekur' rise or set according to MUL.APIN.

No.	Constellation	Rise (according to List 2: morning-first)	Set (according to List 3; in morning twilight (i.e. acronycal setting)
1	Plough	–	–
2	Old Man	Month XII day 15	Month VIII 15 (25)
3	Crook	Month I day 20	Month IX day 15 (sets while Pabilsag rises)
4	Twins	Month III day 10	Month IX day 15 (set while Eagle and U_4.KA.DU_8.A rise)
5	Crab	Month IV day 5	–
6	Lion	Month IV day 15	Month IX 15 (5)
7	Erua	–	–
8	ŠU.PA + Entourage	Month VI day 15	Month IV 15

Table 5: The times of the year when the asterisms of the goddess Gula and the Demon rise and set according to MUL.APIN.

No.	Constellation	Rise (according to List 2: morning-first)	Set (according to List 3; opposition)
1	Gula (Goat)	Month VIII day 15 (25)	Month V day 5 (15)
2	U_4.KA.DU_8.A	Month IX day 15	Month VI day 10

In winter, the constellations of the goddess Gula and the U_4.KA.DU_8.A-demon are successively absent from the night view, and it appears as if they did not offer to the Sitting Gods of the Ekur (Table 5). The name U_4.KA.DU_8.A literally means the 'Demon with the gaping mouth', and is considered a storm demon. The demon does not bow to the Ekur Gods, and he does not join the procession of the god of agriculture (Enlil) and his entourage.

This Demon with the Gaping Mouth (U_4.KA.DU_8.A) rises in Month IX day 15 (I iii 5), one month before the winter solstice when the storms are the strongest during the year. By the way, this perfectly matches Aratus when he states about The Eagle that "… it flies the mighty messenger of Zeus …"; Zeus being a god of thunderstorms is announced by the Eagle south of U_4.KA.DU_8.A in the sky:

> Another bird is wafted, inferior in size, but stormy when it rises from the sea at the departure of the night; and men call it the Eagle. (Kidd, 1997: Aratus verse 315).

The storm demon being related to the rainy (stormy?) season, and the Standing Gods of the Ekur being related to the dry season, suggests a calendar function of the circle of stars in the Path of Enlil.

Figure 7 shows that the risings of Gula and U_4.KA.DU_8.A divide the period between autumn equinox and winter solstice in exact thirds. This scheme also suggests that the rising of the storm-demon announced the stormy season and therefore divided the season of the barley farming in thirds: the first barley harvest, storms, and then the second barley harvest.

In Month VI, ŠU.PA rises on the 15th day (I ii 46) and ten days later (I ii 47), The Furrow (with the ear of grain) rises. This announces the first seeding of barley after the harvests of sesame and dates (around autumn equinox). As barley grows rather fast, one could have at least two harvests of barley before the storm demon appears three months later. After a pause of two months, in Month XI with the rising of The Plough and The Field, people restarted plowing in order to have their barley ready for the celebration of the New Year around the vernal equinox.

2.2.4 The Agricultural Year

The graphical representation of the data in List I2 is displayed in Figure 7 and makes the calendrical function of The Standing Gods of the Ekur rather obvious. The first morning of the Plough initiated the plowing of the fields after

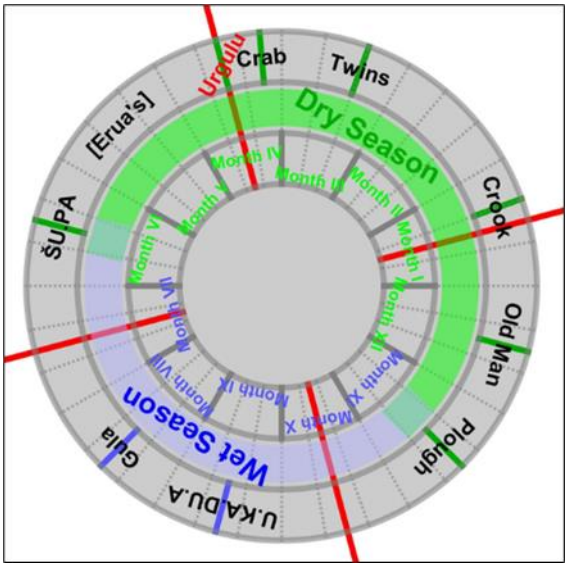

Figure 7: Outer circle shows dates of heliacal risings in ideal calendar according to List 2. Red: solstices and equinoxes.

the winter break and the subsequent seeding and harvesting of barley before the New Year celebration in spring.

The next constellations might have become unimportant for the farming season because farmers were then waiting and caring for sesame and dates to grow. The Crab and The Urgulû (Lion) only indicated the summer solstice with their rise in the beginning and middle of the fourth month, respectively (I ii 41–42). When the asterism of Erua rises (after the Lion, i.e. roughly in the fifth month, not mentioned in List I2) its naming as "GUB-zu sis-sin-nu $^{d}E_4$-ru$_6$" in MUL.APIN line I i 11 (the spadix/ branch/ frond of Erua's date palm) may indicate a relation to date farming. Depending on local conditions and the type of date, dates ripen between August and October. Of course, agricultural products are not automatically harvested when specific stars rise but when the farmer judges that they are ripe. Still, the stars might indicate an average period when it is worthwhile to look out for it more carefully (like every calendar does), because the sidereal year matches the solar year and therefore the seasons.

In conclusion, in the circle of the Path of Enlil in MUL.APIN, we revealed an agricultural calendar. This is a sidereal calendar working with the stars only. As it is totally independent of the lunar months, this calendar matches the modern celestial right ascensions and might have led to the introduction of the ideal calendar in Babylonian astronomy in the first millennium (cf. Ossendrijver, 2012: 32–33). Note that List I1 starts with the Plough (in spring) but List I5 starts with ŠU.PA (in autumn) which might also reflect the two seasons and two 'new year' festivals.

The overlap of eight of the ten asterisms in the list of the Standing Gods of the Ekur with eight *ziqpu*-asterisms in List I5 would, then, indicate a conceptual shift in timekeeping. The compendium MUL.APIN may possibly reflect a turning point from a pre-MUL.APIN calendar of constellations with the Gods of the Ekur towards a later concept of *ziqpu*-stars (cf. Hunger and Pingree, 1999: 84–89) to measure the hours of the night as used in astronomical diaries in the late first millennium BCE. MUL.APIN would then be in the middle of this transformation as its *ziqpu*-list (List I5) consists of two parts: one list of names of asterisms only and a second part where rising constellations in the morning twilight are linked to simultaneous *ziqpu*-asterisms. This apparent duplication or the seemingly redundant listing of names before the actual astronomical information could possibly be an indication of this developmental step at the time of the compilation of MUL.APIN.

3 CONCLUDING REMARKS

We think that we have found a cultural calendar underlying the first list of MUL.APIN. This calendar would have been used to distinguish the two Mesopotamian seasons in the period before MUL.APIN. The dry season (summer) is dominated by the god Enlil, while the wet season (winter), with grain farming, extends from the rising of the constellation of the Furrow with the Ear of Grain (after ŠU.PA-Enlil) by the end of the sixth month (MUL.APIN I ii 47) to the rise of the storm demon U$_4$.KA.DU$_8$.A and its entourage in the ninth month.[1]

The pre-MUL.APIN text that was the base for MUL.APIN's first list may possibly have been a list of ten constellations—as found in the menologies of the astrolabe texts (HS1897). Either the identification of these constellations has changed and the earlier scheme described a circle around the circumpolar area, or the identification has not changed but the earlier list did not describe the full circle but only about two-thirds of it. Either way, the two super-constellations of the goddess Gula and the U$_4$.KA.DU$_8$.A-demon with their related neighbouring constellations, seem to have originated in a different tradition or cultural concept because their definition and text format differs from the asterisms of Enlil. They may have been added later in order to get a full circle of twelve constellations (sections) to cope with the lunar calendar, or they may stem from another geographical region or another city.

Interestingly, the five terms in which List I5 deviates from List I1 (Table 3) are three super-constellations: "The Standing Gods" are read as a procession of Enlil and his entourage, "The She-Goat" is referred to the goddess Gula whose attribute is The Dog, and The Stag is given in line I i31 as part of U$_4$.KA.DU$_8$.A's entourage. Thus, the sequence of terms in lines I iv4-5 (List I5) between ŠU.PA+Dignity and the Old Man, exactly refers to the full circle of the ten Standing Gods of the Ekur plus the two additional super-constellations as derived from the scheme in List I1.

The four sections of the circumpolar area (Sitting Gods of the Ekur) and the half circle of the Standing Gods of the Ekur around it might have been called The Ekur. The deities in Enlil's entourage would then orbit the Sitting Gods in the Path of Enlil.

In this view, the super-constellations of the goddess Gula and the U$_4$.KA.DU$_8$.A-demon would not belong to The Heavenly Ekur but together with the Ekur-asterisms they would make up the Path of Enlil (a god of agriculture) as introduced in MUL.APIN I i39. The Standing

Gods of the Ekur would form a procession led by Enlil (in the form of The Plough) and finishing with Enlil, represented by ŠU.PA-Enlil. Hence, Enlil goes in front of and behind the heavenly procession in the presentation scene, opening and closing the warm season.

4 NOTES

1 Lines I iii 5 reports that U_4.KA.DU_8.A itself rises in the middle of the ninth month, but the Stag, with its entourage, rises in the middle of the eleventh month, as claimed in MUL.APIN I iii 10.

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6 REFERENCES

De Jong, T., 2007. Astronomical dating of the rising star list in MUL.APIN. In *Festschrift für Hermann Hunger, Wiener Zeitschrift für die Kunde des Morgenlandes 97*. Department of Oriental Studies, University of Vienna, 107–120.

Gössmann, F., 1950. *Planetarium Babylonicum Oder die Sumerisch-Babylonischen Stern-Namen*. Rom, Verlag des Päpstlichen Bibelinstituts.

Gullberg, S.R., Hamacher, D.W., Martín-Lopez, A., Mejuto, J., Munro, A.M. and Orchiston, W., 2020. A cultural comparison of the 'Dark Constellations' in the Milky Way. *Journal of Astronomical History and Heritage*, 23(2), 390-404.

Gullberg, J., Hoffmann, S.M. and Gullberg, S.R., 2022. Painting Babylonian: new constellations in Stellarium. In Hoffmann and Wolfschmidt, 170–191.

Hoffmann, S.M., 2020. Babylonian Constellations in Stellarium 0.19.* In Draxler, S., Lippitsch, M.E., and Wolfschmidt, G. (eds.), *Harmony and Symmetry: Celestial Regularities Shaping Human Culture. Proceedings of SEAC Conference in Graz*. Hamburg, Ttredition. Pp. 156–172.

Hoffmann, S.M., 2021a. Das babylonische Kompendium MUL.APIN: Messung von Zeit und Raum. In Meller H., Reichenberger A. und Risch R. (eds.), *Zeit ist Macht: Wer macht Zeit? Time is power. Who makes Time? Tagungsband 13. Mitteldeutscher Archäologentag 2020*. Tagungen des La ndesmuseums für Vorgeschichte, Bd. 24, Halle, Pp. 251–275.

Hoffmann, S.M., 2021b. *Wie der Löwe an den Himmel kam – Auf den Spuren der Sternbilder*. Stuttgart, Franckh Kosmos.

Hoffmann, S.M. and Horowitz, W., 2022. How to identify 'The Plough' MUL.APIN, epinnu? In Hoffmann and Wolfschmidt, 148–170.

Hoffmann, S.M., and Wolfschmidt, G. (eds.), 2022. *Astronomy in Culture – Cultures of Astronomy. Featuring the Proceedings of a Splinter Meeting at the Annual Conference of the Astronomische Gesellschafb, Sept, 14–16, 2021*. Hamburg, Tredition,

Hoffmann, S.M. and Krebernik, M., 2023. What do deities tell us about the celestial positioning system. In Rollinger, R., Madreiter, I., Lang, M., and Pappi C. (eds.). *The Intellectual Heritage of the Ancient Near East: Proceedings of the 64th Rencontre Assyriologique International and the 12th Melammu Symposium, University of Innsbruck, July 16–20, 2018*. Innsbruck, Austrian Academy of Sciences Press. Pp. 539–578.

Hoffmann, S.M., and Horowitz, W., 2023. Standing and Sitting Gods of Ekur. *NABU: Nouvelles Assyriologiques Brèves et Utilitaires*, 3, 141–143.

Horowitz, W., 2014. *The Three Stars Each: The Astrolabes and Related Texts*. Wien, Institut für Orientalistik der Universität Wien.

Hunger, H., and Pingree, D., 1999. *Astral Science in Mesopotamia*. Leiden, Brill.

Hunger, H., and Steele, J.M., 2019. *The Babylonian Astronomical Compendium MUL.APIN*. London, Routledge.

Kidd, D. (ed.), 1997. *Aratus: Phaenomena*. Cambridge, Cambridge University Press (Classical Texts and Commentaries, Number 34).

Kurtik, G., 2007. *Звездное небо Древней Месопотамии. Шумеро-аккадские названия созвездий и других светил* [The Star Heaven of Ancient Mesopotamia: Sumero-Akkadian Names of Constellations and Other Heavenly Bodies]. St. Petersburg, Aletejja.

Ossendrijver, M., 2012. *Procedure Texts*. New York, Springer.

Ruggles, C., and Chadburn, A., 2024. *Stonehenge: Sighting the Sun*. Liverpool, Liverpool University Press.

V ., 2007. The latitude and epoch for the origin of the astronomical lore in MUL.APIN. *Bulletin of the American Society,* 38, 157.

Watson, R., and Horowitz, W., 2011. *Writing Science before the Greek – A Naturalistic Analysis of the Babylonian Astronomical Treatise MUL.APIN*. Leiden, Brill.

Zotti, G., Hoffmann, S.M., Wolf, A., Chéreau, F., and Chéreau, G., 2021. The simulated sky: Stellarium for cultural astronomy research. *Journal of Skyscape Archaeology*, 6(2), 221–258.

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