Proto-Modern Astronomy in the Philippines: A History of Words, 10th- 19th Century

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Abstract

"Proto-modern astronomy" in the Philippines pertains either to an astronomical paradigm or a historical phase that mediates the "pre-modern" (i.e., indigenous Austronesian, since the 3500 BCE) and the "modern" (i.e., brought about by the Eurasian "scientific revolution," 16th century CE). Among the Philippine communities, the existence of proto-modern astronomy implies linguistic contact and socio-cultural interaction with Sanskrit, Arabic, and Malay speakers. Moreover, it shows the Philippine reception of foreign astronomical knowledge and practices before the advent of Euro-American colonialism.

To isolate the proto-modern elements, a discussion on pre-modern Austronesian astronomy is provided. Basic astronomical words can be reconstructed into the follow-

ing protoforms: PAn *laŋiC 'sky, heaven,' PAn *qajaw 'day, sun,' PMP *qalejaw 'day, sun,' PAn *bulaN 'moon,' PAn *bituqen 'star,' PMP *talaq$_1$ 'star,' PPh *bulalákaw$_2$ 'meteor, shooting star,' PPh *dúlis 'meteor, shooting star,' and PPh *dúlit 'meteor, shooting star.' By identifying the foundational elements, we can now recognize the latter additions, marked by Sanskrit-Arabic influences through Malay. These additions appear in the form of words for 'astral science/scientist,' 'heaven/hell,' 'deity/spirit,' 'eclipse,' 'Milky Way,' 'comet,' 'fixed star,' and 'planet,' as well as cosmological, mathematical, and astrological ideas and practices. The period of the study begins in the 10th century CE, the time of the Laguna Copperplate Inscription, which contains the important word *jyotisha* 'astral science; astrologer' and ends in the 19th century, when the Spanish intrusion of the Pulangi Valley, mainly through the Jesuit missionaries, led to the documentation of Maguindanaon, whose astronomical loanwords were clearly from Sanskrit-Malay and Arabic-Malay.

Keywords: Philippine astronomy, proto-modern astronomy, ethnoastronomy, Austronesian languages, Sanskrit, Arabic, Malay

1 Introduction

The development of astronomical knowledge and practices in the Philippines can be roughly divided into three phases: (1) pre-modern, (2) proto-modern, and (3) modern. *Pre-modern astronomy* pertains to

the foundational Austronesian paradigm which is traceable up to 3500 BCE. One may reconstruct this through gathering and interpreting linguistic, historical, and ethnographic sources. *Proto-modern astronomy* is considered as a mediating phase: with the use of the prefix *proto-*, it denotes an early form of scientific knowledge or practice, showing antecedence, if not what the molecular biologist Gunther S. Stent calls "prematurity" (Hook, 2002). Among the Philippine communities, the proto-modern phase implies linguistic contact and sociocultural interaction with Sanskrit, Arabic, and Malay speakers since the 10th century CE. Lastly, *modern astronomy* was brought to the Philippines mainly by the Spanish and American colonizers, with its prominence only occurring in the 19th to the early half of 20th century.[1]

Two reasons can be cited for the needed attention to define and examine Philippine proto-modern astronomy. First, it calls for a re-assessment of Philippine ethnoastronomical studies, specifically the contributions of historian Dante L. Ambrosio (1994, 1996, 1999, 2003, 2005, 2006, 2010). His body of works, best represented by the book *Balatik: Etnoastronomiya: Kalangitan sa Kabihasnang Pilipino* (Balatik: Ethnoastronomy: Sky in Philippine Culture, 2010), offers a novel perspective on Philippine science. In the face of collective forgetting and neglect amplified by Westernized education, colonial mentality, and lack of scholarship, it serves to remind us of our very own "ethno-" and "indigenous" astronomy and sciences. To follow the path that Ambrosio

[1]Other historians resort to the term "pre-modern" in their own specific contexts of study (Schmidl, 2015, 2022). However, being mostly at the receiving end of knowledge transmission (i.e. of "Eurasian astral science tradition," as worded in Plofker, 2015, p. 1984) especially since our indigenous sciences are not only different but also durable, it would be best to categorize the preconquest reception of foreign astronomical knowledge as "proto-modern" rather than "pre-modern."

has set for us, we can further unknot what he calls "indigenous" (*katutubo*). By closely examining the finer threads in this expansive loom of "ethnoastronomy," we will be able to distinguish (1) which knowledge and practices belonged to the foundational Austronesian paradigm, and (2) which were the epistemic products of interaction with our Southeast Asian neighbors. Some primary sources and lexicographic materials are also presently accessible which can be used to update Ambrosio's data and interpretation.

Moreover, by distinguishing which astronomical knowledge and practices were conceived much earlier (since ca. 3500 BCE) and which were received only on a later period (ca. 10th century CE), we may accomplish the second task: to trace lines of influence and reception of foreign episteme. By looking at the Sanskrit, Arabic, and Malay epistemic influences, we can argue for the existence of proto-modern and modern astronomical systems long before the colonial transplant of Western astronomy to the islands. In effect, it implies an alternative view of knowledge networks, a kind of "decentralization" that reexamines the origins of what has been hailed as "modern." Modern astronomy is commonly perceived as an offspring of the "scientific revolution" in sixteenth century Europe (Kuhn, 1957, 1962), with Nicolaus Copernicus, Tycho Brahe, Johannes Kepler, and Galileo Galilei at its forefront (Butterfield, 1962; Reichenbach, 1962; Whitehead, 1925). Such form of scientific "modernity" is characterized by its paradigm shift in what Galileo himself worded as "chief world systems"— i.e., from geocentrism to heliocentrism.[2] However, mostly absent in these stories are the efforts of Muslim

[2] In his highly controversial *Dialogo sopra i due massimi sistemi del mondo* (Dialogue concerning the two chief world systems, Galilei, 1632/1967), Galileo referred to geocentric (earth-centered) system as "Ptolemaic" (*Tolemaico*), after the Alexandrian

intellectuals who studied, translated, and corrected the Greco-Roman astronomical texts (Blake, 2016; Gingerich, 1986; Heidarzadeh, 2015; Masood, 2009, pp. 131–138; Saliba, 1982, 2002; Pingree, 1973). It was the shoulders of these giants, who had their golden age from the 8th to 14th century, on which Copernicus probably stood, along with his book that argued for heliocentrism, *De revolutionibus orbium coelestium* (On the Revolution of Celestial Spheres, Copernicus, 1543/1952).

The period concerned, however, poses a historiographical difficulty—the lack of documentary evidence. Thus, to write a history of preconquest Philippine astronomy, we have to further the cracks on the parchment curtain by employing interdisciplinary approaches, such as those done in historical or diachronic linguistics. This necessitates attention to words referring to astronomy and related sciences. Like Ambrosio's approach, I used historical sources, ethnographic accounts, and literary texts, along with linguistic data mainly from Robert Blust, Stephen Trussel, Alexander D. Smith, and Robert Forkel's *The Austronesian Comparative Dictionary* (hereafter ACD, last updated in 2023). I was also guided by historians and linguists whose insights and interpretation will be cited on relevant occasions. Conversely, this study also tries to "take full advantage of the primary-source archival information" (Walicek, 2007, p. 297), albeit produced under colonial auspices, for the benefit of both disciplines and their practitioners. The period of the study begins in the 10th century CE, the time of the Laguna Copperplate

astronomer and mathematician, Ptolemy (ca. 100-170 CE). His *Mathēmatikē Syntaxis* (Mathematical Composition, ca. 150 CE or later), more popularly known as *Almagest,* provided mathematical proofs for the geocentric argument that had been established by cosmology. For the actual texts, see Ptolemy's (1952) *The Almagest* (ca. 150 CE/1952) and Aristotle's *Physics* (4th c. BCE/1996). Heliocentric (sun-centered) system is called "Copernican" (*Copernicano*), after Copernicus (1543/1952).

Inscription, which contains the important word *jyotisha* ('astral science; astrologer,' ultimately from Sanskrit *jyótiṣa*), and ends in the 19th century, when the Spanish intrusion of the Pulangi Valley, mainly through the Jesuit missionaries, led to the documentation of Maguindanaon, whose astronomical loanwords were clearly from Sanskrit-Malay and Arabic-Malay.

2 Pre-modern Astronomy

In order to establish proto-modern astronomy characterized by influences from Sanskrit, Arabic, and Malay speakers, we have to isolate first the foundational Austronesian-based astronomy. Most of the basic astronomical words used in Philippine communities are traceable to Austronesian protolanguages, i.e. Proto-Austronesian (PAn), Proto-Malayo Polynesian (PMP), Proto-Western Malayo-Polynesian (PWMP), and Proto-Philippine (PPh). These words are reconstructed into the following protoforms: PAn *laŋiC 'sky, heaven,' PAn *qajaw 'day, sun,' PMP *qalejaw 'day, sun,' PAn *bulaN 'moon,' PAn *bituqen 'star,' PMP *talaq$_1$ 'star,' PPh *bulalákaw$_2$ 'meteor, shooting star,' PPh *dúlis 'meteor, shooting star,' and PPh *dúlit 'meteor, shooting star' (Blust et al., 2023; see Section 6).[3] The salience of these Austronesian astronomical

[3]Some remarks on PWMP and PPh categories, in relation to Section 6: Alexander D. Smith (2017) posed an important critique to the PWMP category, and in 2019, Robert Blust himself admitted that "the concept of a WMP subgroup distinct from MP became more difficult to maintain" (Blust, 2019a, p. 427). On PPh, the terrain of debate among linguists can be surmised through reading Lawrence A. Reid's (1982) *The Demise of Proto-Philippines* and Robert Blust's (2019b) *The Resurrection of Proto-Philippines.* The latter earned some responses—from Malcolm Ross (2020), R. David Zorc (2020), Hsiu-chuan Liao (2020), and Reid (2020) himself—and Blust was also able to respond to these comments (Blust, 2020). These papers were compiled in the

protoforms is further proven by several semantic extensions among the reflexes, and the associated mythological and cosmological concepts, beliefs, stories, and customs.

Since protoforms are reconstructed according to a particular level of protolanguage, and since these levels correspond to a certain period of formation (Bellwood et al., 2011; Bellwood, 2017; Blust, 2019a), we may identify possible timeframes relevant in periodizing the Austronesian astronomical paradigm (Table 1).

Table 1. Possible Formative Periods of Austronesian Astronomical Concepts

Period	Level	Gloss	Protoform
As early as 3500 BCE	PAn	'sky,' 'heaven' 'day,' 'sun' 'moon' 'star'	*lanjiC *qajaw *bulaN *bituqen
As early as 2200 BCE	PMP	'day,' 'sun' 'star'	*qalejaw *talaq$_1$
	PPh	'meteor,' 'shooting star'	*bulalákaw$_2$ *dúlis *dúlit

Since the said words contains meanings other than the astronomical, we may designate primary and secondary meanings based on the protolanguage levels and the cognate sets. In other words, precedence can be proposed according to the possible age and frequency of words and meanings. For the astronomical paradigm, there can be three possi-

volume 59, no. 1-2 (June/December 2020) of *Oceanic Linguistics*. Nonetheless, for Section 6, I maintained the PWMP and PPh categories in accordance with the ACD data (Blust et al., 2023).

bilities for the ordinality of meanings among the protoforms discussed above:

(i) the non-astronomical meaning precedes the astronomical;

(ii) the astronomical precedes the non-astronomical; and

(iii) no lexical precedence can be justified, thus the astronomical and the non-astronomical possibly co-exist at the same time.

Ambrosio emphasized the likelihood of (i), as shown in the case of *Balatik* 'Orion' constellation.

> What is *balatik* on land before it became *Balatik* in the sky? It is a kind of trap used for hunting by different ethnic groups in the Philippines… What is Balatik? It is a constellation that looks like and is named after the balatik trap. Thus, from the fields and forests, the Filipinos elevated it to the sky. Although it was used for hunting on land, it was used for slash-and-burn farming when it was placed in the sky. Among the dictionaries compiled by Spanish priests and the ethnographic studies during the twentieth century, it pertains both to a trap and the reference constellation for slash-and-burn farming (Ambrosio, 2010, p. 9).

However, by looking at protoforms individually, this is not always the case. Table 2 organizes Blust, Trussel, Smith, and Forkel's ACD data based on the above categories. Of course, we are aware of ACD's limitations, from the expected accuracy of orthography to the range of

meanings. The table can be further revised through future acquisition of additional data, either via archival or field work.

Table 2. Semantic Ordinality of Austronesian Astronomical Words

Protoform	**Meanings**	**Number of languages in the Philippines where astronomical (+), non-astronomical (-), and both (+, -) meanings appear**	**Type of semantic ordinality**
PAn *lanjiC	'sky, heaven' > 'spirits of the sky,' 'skyworld,' 'celestial,' 'Heaven' (i.e. with religious connotation), 'eternity,' 'joy, happiness'	23 (+) > 8 (+, -) > 0 (-)	(ii)
PMP *qalejaw	'day' > 'sun' or 'day' = 'sun'	10 (-) = 10 (+, -) > 2 (+)	(i) or (iii)
PAn *bulaN	'moon' = 'month' or 'moon' > 'month'	21 (+, -) >/= 8 (+) >/= 0 (-)	strongly (iii), but (ii) is initially probable
	'moon' = 'month' > 'menstruation,' 'pregnancy duration'	26 (+) > 3 (+, -) > 0 (-)	(ii)

Protoform	**Meanings**	**Number of languages in the Philippines where astronomical (+), non-astronomical (-), and both (+, -) meanings appear**	**Type of semantic ordinality**
PAn *bituqen	'star' > 'for the stars to come out after a rain shower' 'be starry, of the sky,' '*Barringtonia asiatica*'	16 (+) > 3 (+, -) > 1 (-)	(ii)

Protoform	Meanings	Number of languages in the Philippines where astronomical (+), non-astronomical (-), and both (+, -) meanings appear	Type of semantic ordinality
PPh *bulalákaw$_2$	'spirit of the shooting star,' 'rainbow,' 'a kind of eel,' 'whiteness,' 'a fireball with a tail,' 'St. Elmo's fire,' 'a kind of bird,' 'a supernatural being,' 'nature spirit, deity,' 'craze, madness, insanity (caused by evil spirits),' 'god of the fish' >/= 'shooting star, meteor, comet'	7 (-) >/= 5 (+, -) >/= 4 (+)	(i), but given the variety of non-astronomical meanings, it is probably (iii)

PMP *qalejaw exhibits two possible scenarios. First, it can be a type (i), wherein its non-astronomical meaning ('day') has appeared earlier

(and thus, historically "stronger") than its astronomical meaning ('sun'). Considering the doublet PAn *qajaw 'day' as earlier protoform, it appears that 'sun' in PMP *qalejaw is an extension of 'day.' This phenomenon is mirrored in the Bahasa Sug *suga* 'sun,' which expanded from the Bisayan *suga* 'lamp' (Hassan et al., 1975, p. 521; Wolff, 1972/2014).[4] Second, it can be a type (iii), as shown in the number of languages that argue for it [10 (-) = 10 (+, -)]. This is also supported by the specific reflexes in PAn *qajaw 'day' (see Paiwan *qadaw* 'sun; day; clock, watch' and *pa-qadaw* 'put in the sun (to dry); use a burning-glass,' Tamalakaw Puyuma *kadaw* 'sun'), and also in PAn *ma-qajaw 'sunny, hot' (see Paiwan *ma-qadaw* 'the sun appears; be burned by sun') and PAn *q<um>ajaw 'to shine, of the sun' (see Paiwan *q-m-adaw* 'the sun shines' and Ifugao *um-algó* 'to shine, of the sun'). Such semantic duality is further shown in PMP *qalejaw-qalejaw 'daily, every day,' PPh *qalejaw-an 'place in the sun,' and other protoforms with uncertain glosses, like PWMP *maŋ-qalejaw, PWMP *paŋ-qalejaw-an, and PPh *ka-qalejaw-an.

For PAn *bulaN, given that there are eight languages that refer to **bulaN* as 'moon' and none as solely 'month,' it appears that 'moon' is the primary meaning of *bulaN, followed by 'month,' therefore a type (ii) case. However, given the large number of languages—twenty-one—that pertains to *bulaN as both 'moon' and 'month,' we may say that it can also be a type (iii) case. How these two meanings converged can be scrutinized in the future. On PAn *bulaN as type (ii), i.e. 'moon'

[4]Interestingly, terms for 'east' which use the rising of sun as referent often pertain to the action (i.e. rising) rather than its actor (i.e. sun), as observed in the reflexes of PPh *sebaŋ 'to rise, of the sun, moon, or stars' like the Bikol, Cebuano, and Bahasa Sug *subangan*, Maguindanaon, Maranao, and Teduray *sebangan*, Mamanwa *sibazan*, and Sama *sobangan*, and PPh *sikat 'sunrise, rising sun,' like the Casiguran Dumagat *sikat* (Gallego, 2018, pp. 68–69).

= 'month' > 'menstruation,' 'pregnancy duration,' we can observe the relationship between an astronomical body, timekeeping, and women's body and health.[5] Moreover, PWMP *bulan-en and *bulan bulan-en 'affected by the moon, mentally or emotionally unstable' are also suggestive of a phenomenon wherein people's health is seen through an astrological perspective.

Since the categorization of type (iii) mainly rests upon "equivalence," as shown in PMP *qalejaw and PAn *bulaN, a future updating of the ACD would entail recategorizations. Nonetheless, for PPh *bulalákaw$_2$, although it appears to be a type (i) case, due to the varieties of meanings—eleven non-astronomical meanings that differ significantly from each other—we may categorize the word under type (iii).

As cases of type (ii), the astronomical meanings of PAn *laŋiC and PAn *bituqen extend into other semantic domains. On PAn *laŋiC, the expansion hints religious and cosmological aspects. In Blust et al. (2023), it is remarked that, "in most languages it seems to have referred not only to the physical sky, but also to a mythological realm of spirits," something that Ambrosio (2010, pp. 47–48) had shown in *Balatik* through comparative ethnography. On PAn *bituqen, aside from flora and fauna ('starfish;' '*Barringtonia asiatica*'), the meaning extends to astronomical bodies and phenomena, not only as sky description or action ('for the stars to come out after a rain shower;' 'be starry, of the sky'), but also as 'comet' (Tagalog *bituing may sombol*; Maguindanaon *bituun bericor* and

[5] This can also be compared to the Bisayan *tuig* 'time; year; harvest; menstruation.' In the essay *Harvest Time,* Resil B. Mojares (1997, p. 119) wrote, "It is not stray coincidence that *tuig*—'harvest'—is also an old Visayan term for a woman's menstrual flow, a mystery that evokes not only what is periodic but what is irrigative and life-giving."

bituun berasap), 'fixed star' (Maguindanaon *bituun tatap*), and 'planet' (Maguindanaon *bituun beridar*) (*Compendio y breve vocabulario*, 1888, p. 85; Noceda & de Sanlucar, 1832, p. 375).

There are other words, however, that cannot be traced to a proto-form. In Mangyan languages, for example, the words for 'star' do not reflect *bituqen. Rather, words such as *paŋgasán, faŋgasán, galeme, galaymay,* and *magirəm* embody "a more inventive example of innovation" (Ambrosio, 2010, pp. 32, 37, 44–45; Scott, 1984, p. 46). William Henry Scott (1984, p. 46) also described the Hanunóo *panggasan* and the Buhid *fanggasan* as "a rather poetic extension of the word for the holes punched in the ground for seed rice." Shown in Table 3 are the said Mangyan words derived from Zorc (1982),[6] with additional data provided by linguist Jesus Federico C. Hernandez (personal communication, 2023).

[6]Zorc explained the case of the Mangyan stars: "The PAN word for 'star' is reconstructed as *bi(n)tu:q-ən… In all Mangyan languages it has been replaced: Hanunoo *paŋgasán:* Buhid *faŋgasán,* Taubuid *galeme:* Tadyawan *galaymay,* Alangan, Iraya *magirəm.* Lexicostatistical and other evidence would agree that the Hanunoo-Buhid form is a South Mangyan innovation, and that the Alangan-Iraya form is a North Mangyan innovation. There is no doubt that the Taubuid and Tadyawan forms are cognate and represent an innovation, but there is: (a) no (other?) qualitative evidence that Taubuid and Tadyawan belong in an immediate subgroup (b) no lexicostatistical evidence that they share any especially close genetic connection (c) the fact that the two languages border one another, and (d) the observation that [g] is problematic in Tadyawan since *R > y in most basic vocabulary, while *R > g in Taubuid.. Therefore, the North and South Mangyan innovations stand along with other evidence, but it is clear that a Tadyawan innovation (*galaymay) was borrowed early into Taubuid, and then underwent the *ay > e sound shift" (Zorc, 1982, pp. 314–315).

Table 3. Mangyan Words for 'star'

Micro-Group	Language	Words	
		Zorc (1982)	Hernandez (2023)
North Mangyan	Alangan Iraya	*magirəm*	*magirëm* [ma.gɪ.ˈrəm]
	Tadyawan	*galaymay*	
Greater Central Philippine > South Mangyan	Tawbuid	*galeme*	*galeme* [ka.ˈlɛ.mɛ] *tagurabas* [ta.gʊ.ˈra.bas]
	Buhid	*faŋgasán*	*fanggasan* [faŋ.ga.ˈsan]
	Hanunoo	*paŋgasán*	*pamgasan* [pam.ga.ˈsan][7]

Source: Zorc (1982); Hernandez (personal communication, 2023).

Some words are thought to be borrowed from a foreign source but are in fact Austronesian-based. Such are the cases of Bahasa Sug *suga* and Tagalog *tala?*.

In *The History of Sulu*, historian Najeeb M. Saleeby (1908) mentioned that the parents of the Muslim missionary Tuan Masha'ika, Jamiyun Kulisa and Indira Suga, "are mythological names and in all probability represent male and female gods related to the thunderbolt and the sun, respectively." He implies that *suga* is based on "Surya, the sun" (Saleeby, 1908, pp. 155–166; see also Donoso, 2013, p. 142). *Suga*, however, refers

[7] *Pamgasan* also appeared in Hanunoo Mangyan oral literature recorded in Bapa/Antoon Postma's *Kultura Mangyan 2*. *Pamgasan* is the answer for the riddle "Namurak ti diyaa;/ Ud mabilang makas-a" (The Diyaa bears fruit,/ Can't count even a single one) (Postma, 2005, p. 119). The poem "Dayo siya sa abwat pagkatungkulan" (It doesn't like higher duties), the *pamgasan* named Kuyamnagan speaks with Bulan (Moon) to exchange names and tasks (Postma, 2005, p. 117).

to 'the sun' in Bahasa Sug, a counterpart to *adlaw*, 'day, a period from sunup to sundown, may also refer to day time as opposed to night time' (Hassan et al., 1975, p. 9). Its meaning is possibly a secondary expansion of the Bisayan *suga* 'lamp' (Wolff, 1972/2014).

Citing the Indologist Juan R. Francisco, Ambrosio (2010, p. 39) rooted the Tagalog *tala?* from the Sanskrit तारा *tārā* 'star.' This seems implausible given that Ifugao and Mansaka, languages spoken mostly in the interior, has *talló* 'bright morning or evening star, the planet Venus,' and *bontatara?* 'morning star,' respectively. The Franciscan friar Juan de Plasencia referred to *Tala* as 'morning star' (de Plasencia, 1589/1903, pp. 188–189), as well as Jose Rizal, who, in a letter to his friend Ferdinand Blumentritt, mentioned Tagalog *tálâ* as 'bright star' (*lucero*) and 'morning and evening star' (*Morgenstern, Abendstern*) (Rizal, 2010, pp. 57–59). With these, Blust et al. (2023) provides the PMP *talaq$_1$ 'the morning (evening) star: Venus.' In addition to the ACD data on Ifugao and Mansaka reflexes, *talaw* 'star' is also used in Kankanaey (Fong, 2021, pp. 19–23; Ramos, 2022, p. 86) and Central Bontok (Bontoc Igorot) (Wrigglesworth, 1991, pp. 230–233), while the pre-Ibaloi reconstruction *talaw 'star' is also being proposed (Barra et al., 2023, p. 85). Moreover, Sanskrit words would usually pass through Malay before entering Tagalog and other Philippine languages. Malay and Javanese did not borrow *tārā*; instead, they have *bintaŋ* 'star,' or *wintaŋ* in Old Javanese.[8] The absence of the

[8]Assessing Otto Dempwolff's proposed *bintaŋ 'star,' Blust et al. (2023) settled with the following explanation: "This comparison is especially problematic, since it involves an item of basic vocabulary which appears to have been widely borrowed, in most cases presumably replacing a reflex of PAn *bituqen. In addition to competition with the more widely distributed *bituqen, phonological irregularities and the frequently reflected secondary meaning 'medal, decoration' suggest that this comparison is a product of diffusion. On the other hand, the basic character of the term, and

Malay or Javanese intermediary in the proposed *tārā* > *tala* suggests that the PMP *talaq$_1$ is possibly a Philippine innovation rather than a product of borrowing.

Generally, we cannot say yet that these words, along with the concepts and practices they carry with them, were organized into a "proper" system. Given our current set of historical primary sources and linguistic data, the Austronesian astronomical paradigm reflects what philosopher Michel Foucault calls "insufficiently elaborated knowledges," which "should be understood as meaning something else and, in a sense, something quite different" (Foucault, 2003, p. 7). This "insufficiency" is apparent in the absence of Austronesian words for 'astronomical science' and 'astronomer.' Astronomical knowledge and practices, along with those of the other sciences, are possibly contained in an umbrella term, PPh *dunuŋ 'knowledge, skill, intelligence' (Blust et al., 2023), while the astronomer or astrologer might be found in the figure of *babaylan* and *katalonan*, the keepers of indigenous knowledge.

Such absence can also be attributed to the method and function of knowledge. It seems that Austronesian Filipinos were already content with how their astronomy served its purpose of time and weather-keeping for agricultural and maritime activities. Their established cosmologies, too, gave them no reason to examine the world and the cosmos

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its integration into a number of culturally significant expressions (names for stars important in the traditional agricultural calendar, the Karo Batak term for rice-milling songs, etc.) give one hesitation about a borrowing hypothesis in particular cases. More precisely we should say that *bintaŋ was an innovation in a language which gave rise to Malay and certain of its closest relatives. With the ever-increasing influence of Malay after the rise of Indianized states in southern Sumatra the word then spread to languages which did not inherit it directly (including Malagasy, which presumably acquired it during the 7thcentury A.D. in southern Sumatra)."

the way the Babylonians, Hebrews, Greeks, Chinese, Indians, Arabs, and Europeans did. Just like what Petra G. Schmidl (2015, p. 1928) said about folk astronomical procedures, the Austronesian tradition mostly "make[s] use of straightforward arithmetical methods, not trigonometric procedures, geometrical models, and analemmata… [and does] not distinguish between exact and approximate methods." This issue of epistemic process and relevance further strengthens the divide between the Austronesian-Philippine tradition and its Eurasian counterparts (including Sanskrit-Arabic). As Francisco Ignacio Alcina, a Jesuit priest, reported about the "liberal arts and sciences" of the Bisayans in the 17thcentury:

> For one and the other, some astronomical principles pertaining to the skies, the planets and their influences were a necessity; based on their appearances and positions, they had made their judgments but in a rather *grosso modo*, in order to determine the seasons and to take advantage, in advance, of the proper time for sowing and planting and of the tranquil or stormy weather for sailing. They made use of the knowledge of both with a reasonable measure of success.
>
> Therefore, although they did not have teachers who may have instructed them, nor scholars who may have informed them, we do know that whatever pertains to the heavens and its course, to the planets and their influences, they have known something, either from tradition of their ancestors or from the experience that time passed on to them. And so, whatever pertains to the sphere and the roundness of

> the earth, its matter and qualities, they were ignorant of these to a great degree (Alcina, 1668/2005, p. 55).

However, as the adage goes, the absence of evidence is not evidence of absence, and as linguist Maria Kristina S. Gallego (2018, p. 66) reminds us about negative evidence, "the lack of [words in documentary sources] may simply be the result of incomplete lexicographic work rather than the actual absence of such terms in the lexicon of the language."

3 Proto-Modern Astronomy

Astronomical knowledge and practices registered in Sanskrit-Malay and Arabic-Malay found their way into the Philippine communities through complex cultural interactions. Texts using a mix of Sanskrit, Arabic, and Southeast Asian languages are themselves proofs of these interactions. Borrowings are a common phenomenon since these foreign languages, with their set of scripts, may embody prestige and relevance when it comes to religious, sociopolitical, and economic matters.

On one hand, the spread, use, and modification of Sanskrit in Southeast Asia went hand in hand with the so-called "Indianization," as seen in Mon (3rd century BCE), Funan (1st century CE), Champa or Lin-yi (2nd century), Burma (2nd century), Pyu (3rd century), Chenla (6th century), Srivijaya (7th century), the Sailendras (8th century), Mataram (10th century), Kediri (11th century), Singhasari (13th century), Sukhothai (13th century), Ayutthaya (14th century), Majapahit (14th century), and the pre-Islamic Malacca (15th century) (Coedès, 1968; SarDesai, 2013, pp. 21–58; Tarling, 1966, pp. 24–26). Old interpretations of scholars argued that the Philippine communities also received "the

stimuli of Indian influences common to the region" (Churchill, 1977, p. 21), although these have been interrogated by contemporary studies.[9] Arabic, on the other hand, was introduced to the region even before the establishment of Islam in the Arabian Peninsula in the 7th century, due to the preexisting trade relations between the Arabs, the Southeast Asians, and the Chinese. Its vernacularization, however, occurred along with the Islamization of insular Southeast Asia. This was initially enabled by the Indian Muslims, either from Gujarat or Coromandel, who later attained economic and political prominence in Sumatra and beyond. As early as the 10th century, there were already Muslim Chams in Southern Vietnam; however, the large extent of the Islamic influence was observed in its spread in the Indo-Malay Archipelago since the 13th century. In 1414 happened the conversion of Melaka (Malacca), an important trading port in the region (SarDesai, 2013, pp. 54–58). Islamized Philippine communities and ethnic states can be found in Sulu, Mindanao, and Manila. Missionary efforts from the 13th to 16th century led to the formation of Muslim ethnic states, such as the Sulu and Maguindanao sultanates (Donoso, 2013, pp. 118–173; Majul, 1976).

Given these contexts, we need to emphasize the role played by our Southeast Asian neighbors in transmitting into the Philippine commu-

[9]In order to "conceive a nuanced notion of a 'Malay World,'" Clavé and Griffiths (2022, p. 217) asserted that the use of Sanskrit in early Southeast Asia does not necessarily imply "the migrations and political domination from India that now-discredited theories of 'Indianization' imagined." Treat this as a response to Churchill's (1977, pp. 36–37): "With respect to Sanskrit borrowings in the Philippine languages, much discussion has centered on whether the borrowings were directly from Sanskrit or from an intermediate Malay language. This misses the point; the significance of the Sanskrit borrowings lies in the nature of the words themselves;" "In other words, the borrowed words would almost certainly have been absorbed directly from possessors of a living Hindu tradition."

nities the cultures, beliefs, knowledge, and thought registered in Sanskrit and Arabic languages. In other words, what we received in Sanskrit and Arabic may not be the Indian or Arabian original—rather, it would be an amalgam of the Indian and Arabian sources and the Southeast Asian intermediary.

Most likely, this intermediary is Malay. Dated 7th century, the earliest record on Malay language can be found in south Sumatra. The record used Old Malay and the script called Pallawa, a South Indian adaptation of the Brahmi script. Other inscriptions were found in Java (dated 9th-10th century), in the Philippines (10th century), and in Minangkabau and Aceh (14th century) (Adelaar et al., 1996). The prominence of Malacca as an economic center in the region made Malay as a lingua franca, and thus a major borrower of Sanskrit and Arabic words (Ostler, 2005, p. 213). In terms of Malay as intermediary and donor to Philippine languages, Blust remarked, "The presence of hundreds of Sanskrit loanwords in the Philippines—an area that was never directly exposed to Indian civilization—should cause us to suspect strong Malay linguistic influence in the area, since Malay is the most likely candidate for a language of transmission of Sanskrit vocabulary from areas that were directly exposed to Indian civilization" (cited in Ambrosio, 2010, p. 45, 11f). Aside from Philippine languages, Malay also served as an intermediary between Sanskrit-Arabic and Malagasy (Adelaar, 1994).

In line with this, scholars who argued for the existence of a Philippine "Hindu-Buddhist" past (e.g. Churchill, 1977) have failed to recognize the active role of the so-called "Malay World" in filtering, modifying, and transmitting Indian (and later, Arabian) influences. Recall the century-

old comment of A.L. Kroeber against T.H. Pardo de Tavera on Sanskrit in the Philippines:

> From this he [Pardo de Tavera] goes on to argue that Hindus must have been present in the Philippines in person, and at least among the Tagalog filled the principal positions of power and prestige: "the warfare, religion, literature, industry, and agriculture were at one time in the hands of the Hindus." This is perhaps an exaggerated inference. East Indians saturated with Hindu civilization could just as well have produced the same effects in the Philippines. But it is clear that the effects occurred; and it will be only a matter of more patient and critical study to trace them with considerable accuracy, and perhaps even determine their period quite closely (Kroeber, 1919, p. 202).

Enactments of this task are already plenty (Adelaar, 1994; Adelaar et al., 1996; Clavé & Griffiths, 2022; Salazar, 1968; Verstraelen, 1960; Wolff, 1976). These studies emphasized the role of Malay in relaying Sanskrit and Arabic borrowings to Tagalog, Cebuano, Bikol, Maguindanaon, Maranao, Bahasa Sug, and other Philippine languages, exhibiting the "intensity of Malay influence" (Zorc, 1993, p. 205). Although Zorc attributed such "intensity" to Tagalog borrowings, thus implying the stature of Tagalog as a precolonial lingua franca, we can also look at the languages in the Philippine South to see how Malay "made its mark" beyond the confines of Tagalog. In fact, it is among these southern languages that would attest to the continuous flow of non-indigenous scientific words and ideas, admirably despite Western epistemic violence.

Maguindanaon, for instance, preserved the Arabic-based planet names, while Tagalog did not.

By the time Malay had "appreciable influence" in Sulu, Mindanao, and the Tagalog region (Wolff, 1976, p. 345), the so-called "Eurasian astral science tradition" (Plofker, 2015, p. 1984) had already achieved significant development through scientific and cultural interactions. The said term covers the Hellenistic, Indian, Arabian, Persian, Asia Minor (including both the Christian Byzantine and the Islamic Ottoman) and early modern European traditions (Plofker, 2015, p. 1984). As early as the 3rd to 6th century, the Indian *siddhāntas* 'astronomical treatises' had shown Greco-Roman influences, and by the early 8th century, Indian adaptations of Greco-Roman and Babylonian techniques reached China through Chinese translations (Blake, 2016, pp. 15–16; Dallapiccola, 2002, pp. 104–105; Pingree, 1973, p. 32). From the 7th to 10th century, the spread of faith from the Arabian Peninsula led to the establishment of Islamic communities in West and Central Asia, India, North Africa and the Iberian Peninsula. Since the 8th century, exchanges between Indian and Muslim communities led to parallel innovations in their own astral sciences (Dallapiccola, 2002, pp. 104–105). Engaging with multiple cultures, the Islamic intellectual tradition benefitted from Persian, Syrian, Indian, and Hellenistic sources (Heidarzadeh, 2015, p. 1917), particularly absorbing the Greco-Roman system of cosmology and physics (Chapman, 2018, p. 32). Ptolemy's *Mathēmatikē Syntaxis* (Mathematical Composition, ca. 150 CE or later) would find its way to medieval Europe through the Arabic mediation in the 8th and 9th centuries. In fact, its popular title, *Almagest*, is an Arabic corruption (*al-majisṭī*) of the Greek *megiste*, 'greatest,' derived from a later title, *Hē Megalē Syntaxis* 'The

Great Treatise.' The Arabic *Almagest* had at least four translations, which probably passed through Syriac translations of the original (Heidarzadeh, 2015, p. 1917; Pingree, 1973, pp. 34–35). Although "they never offered a thoroughgoing alternative" to the Ptolemaic system, only "pointing out contradictions and offering corrections," Stephen P. Blake (2016, p. viii) argued that it was the "insights and discoveries [of these Islamic astronomers and mathematicians] that paved the way for the grand revolution that followed." Referring to the 8th to 14th century as the "Islamic period of astronomy," Owen Gingerich (1986, p. 74) wrote, "During that interval most astronomical activity took place in the Middle East, North Africa and Moorish Spain. While Europe languished in the Dark Ages, the torch of ancient scholarship had passed into Muslim hands. Islamic scholars kept it alight, and from them it passed to Renaissance Europe."

3.1 Sanskrit-Malay

In contrast with the PPh *dunuŋ 'knowledge, skill, intelligence,' which found its nationalized form in the Filipino *karunungan*, we have another word that corresponds to 'science'— *agham*. Although it was popularized by Gonsalo del Rosario as an equivalent for science in the contemporary sense of the word (see Guillermo, 2009), *agham* and its variations are already in use among Philippine ethnolinguistic groups, although with a different meaning. Ultimately from Sanskrit, Old Javanese defines *āgama* as 'sacred tradition, doctrine or precepts; collection of such doctrines; sacred work,' while in Malay and Javanese, *agama* (or *igama, ugama*) is simply 'religion.' In Maguindanaon and Maranao, it is also 'religion' (Blust et al., 2023). A Maguindanaon dictionary also men-

tioned *peragama* 'to practice or to exercise religion,' *agama a benal* 'true religion,' and *agama mesehi* 'Christian religion' (Juanmartí, 1892, p. 7). *Agama* can be compared with the Arabic-based *ilmu*, to be discussed later, being closer to the meaning of science and knowledge.

The Sanskrit term, however, for the science of the heavens and heavenly bodies is *jyotiṣa* (also spelled *jyotisha*). It is derived from the ज्योतिस् *jyótis*, 'light.' Since this term "can encompass astrology and divination as well as astronomy" (Plofker, 2015, p. 1982), scholars would sometimes use the more generic 'astral science' (Clavé & Griffiths, 2022, pp. 188, 196–198). The sacred Sanskrit texts known as *Vedangas* 'limbs of the Veda' include the *Jyotiṣavedāṅga* (Ôhashi, 2015), although the predecessors of this text were probably "imported from Mesopotamia and from Persia" (Dallapiccola, 2002, p. 105). As early as the 2nd century CE, a Greek astrological text was adapted to Sanskrit, and by the 3rd to 4th century, Indian astronomers would be reading the *Yavanajataka* (Greek Astrology, ca. 269-70) and the *Romaka Siddhānta* (Roman Astronomical Treatise, ca. 4th century). Antedating the Arabic *zij*, the Indian *siddhāntas* 'astronomical treatise' were made and used, like the *Sūrya Siddhānta* (lit. 'Sun Treatise,' ca. 400 CE) and the *siddhāntas* of the Indian scientists Aryabhata (ca. 476-550), Brahmagupta (ca. 598-665), Bhaskara (ca. 600-680), and Aryabhata II (920-1000). Brahmagupta's own *siddhānta*, titled *Brāhmasphuṭasiddhānta* (628), was translated into Arabic as *Zij al-Sindhind* (The Indian Astronomical Treatise, 770), marking an influence on Islamic astronomy (Blake, 2016, pp. 15–18). Conversely, the establishment of sultanates in India, such as the Delhi Sultanate (est. 1206), led to the adoption of Greco-Islamic astral traditions (Plofker, 2015, p. 1987).

Looking specifically on the Sanskrit-Malay contribution to Philippine astronomy, we can identify several additions to the foundational Austronesian paradigm: (1) a label for astral science or scientist, (2) new timekeeping methods, and (3) astronomical words and concepts that are associated with Indian-Malay mythology, religion, and culture. By separating these "additions," we are also assuming that the basic astronomical words and concepts from Austronesian languages remained, either maintained in their original form and meaning, or slightly modified. (This would also be the case for Arabic-Malay, to be shown later.) Our main dated document here is the 10th century Laguna Copperplate Inscription, to be coupled with late 19th century language materials on Mindanao.

3.1.1 Jyotisha as Science or Scientist

A 10th century receipt of debt acquittal, the Laguna Copperplate Inscription (LCI) contains Old Malay words and Sanskrit borrowings in Jawi, a Malay adaptation of the Arabic script. In the opening of the text, an important word appears: *jyotisha*. It was interpreted in various ways by scholars.

(1) "Hail! In the Saka-year 822; the month of March-April; according to the astronomer [*jyotisha*]: the fourth day of the dark half of the moon; on Monday" (Postma, 2005)

(2) "Greetings! Shaka year 822, month of Waisakha according to the stars [*jyotisha*], fourth day of the waning moon, Monday" (Santos, 1996)

(3) "Hail! Elapsed Śaka year 822, month of Vaisākha according to the astral sciences [jyotisha], fourth of the waning fortnight, a Monday" (Clavé & Griffiths, 2022)

The shift from 'astronomer' to 'stars' to 'astral sciences' indicates the increasing awareness of scholars about the meaning and use of the term, not only in its Indian but also Malay and Javanese contexts. In what can be considered as the most definitive attempt to read the LCI, Clavé and Griffiths (2022, p. 188) defined *jyotiṣa* in the LCI:

> *jyotiṣa* (1): According to Amrit Gomperts, "Jyotiṣa is the general Sanskrit word for Indian astronomy, astrology and divination, while the Old Javanese word jyotiṣa means 'astrologer.'" In fact, the word can designate both astral science and a specialist thereof in Sanskrit. Although a person called Bhagavanta Jyotiṣa occurs in the Old Javanese Palepangan inscription (906 CE), line 3, and Postma has interpreted diṁ jyotiṣa as "according to the astronomer," it seems more likely to us that the science rather than the expert is intended here.

In the context of Indo-Malay reception, Bambang Hidayat also cited another study by Gomperts indicating "that the Sanskrit astronomy text *jyotisa* brought over from the present Southeast Asian region received only very slight modifications" (Hidayat, 2000, p. 376). However, in the case of LCI, Clavé and Griffiths suggested a different scenario. Although the need for precise dating is crucial for the traditional *jyotisha*, especially since it is used for performance of sacred rituals (Blake, 2016, pp. 14–15; Dallapiccola, 2002, pp. 104–105; Plofker, 2015, p. 1983), Clavé and

Griffiths (2022, p. 198) emphasized that "the way the date is expressed reveals simultaneously a clear impact of Javanese documentary culture, some agreement with Malay documentary culture, and a small (possibly local) adaptation of Malay and Javanese patterns." Nonetheless, the terms that appeared in the LCI was based on the Indian *pañcāṅga* ('five-element' calendar system) from the popular *Sūrya Siddhānta* (Clavé & Griffiths, 2022, p. 196; cf. Blake, 2016, pp. 15–16). This dating formula, Clavé and Griffiths argued, can also be found among Old Malay and Old Javanese inscriptions, like the Talang Tuwo stone inscription from South Sumatra and the Humanding copperplate inscription from Central Java, respectively. The use of such dating system was possibly so popular that the term for year or era, *saka*, was even attributed to the coronation year of Aji Saka (Aji Soko or King Syaliwohono), the legendary founder of Java (Ma'u, 2019).[10] The difficulty in determining the exact meaning and function of *jyotisha* in 10th century Philippines resides partly in its unique appearance. An example of "hapax legomenon" or a word that occurs only once in a text or a body of texts, Clavé and Griffiths (2022, p. 198) wrote that "the use of the words diṁ jyotiṣa finds no analogy in any Indonesian dating formula that we know." Other comparable inscriptions, as identified above, did not conjure the word for 'astral science/astronomy' or 'astronomer/astrologer' to justify the validity of the date. Thus, more sources are needed to properly examine the historical role of *jyotisha* in Philippine proto-modern astronomy.

[10]There are three calendars in Java, into which adds the Christian (Julian) calendar (starting with 1 Anno Domini or A.D.): the Javanese Hindu calendar, using the Saka or Soko era (78 CE), the Islamic calendar, using the Hijrah era or Anno Hegirae in Latin (622 CE), and the Islamic Javanese calendar implemented in 1633 by Sultan Agung Anyokrokusumo of Mataram, which combines the two preceding calendars (see Ma'u, 2019).

3.1.2 New Timekeeping Methods

Astronomy is closely linked with chronology, as once articulated by the German astronomer and mathematician Johannes Kepler (see Knickerbocker, 1927, pp. 29-35, esp. p. 31), and such linkage is not only confined in Europe, but can also be observed in other scientific traditions such as those in the Indo-Malay Archipelago and the Philippines (Ambrosio, 2010; Ammarell, 2008; Hidayat, 2000; Manapat, 2011; Ma'u, 2019). Aside from words in local mathematics,[11] Sanskrit-Malay influences can also be seen in astronomical timekeeping.

Kutika, *kutikaan*, *pakutikan*, *putikaan*, or *pati kiraan* are almanacs or astrological charts made and used by Muslim Filipinos and Indonesians. Among these texts one can find surviving Sanskrit names that possibly hailed from the pre-Islamic Malay world and were preserved through writing. The *kutika* can therefore be a textual proof of concepts and practices that subscribe to the so-called "folk Islam"—especially since astrology is traditionally forbidden by Islamic sects, if not a subject of criticism by Muslim scholars and scientists (Saliba, 1992; Ziaee, 2012).[12]

Although there was a mention of Basilan *cuticaan* by the Jesuit Father Pablo Cavalleria in 1886 (Ambrosio, 2010, p. 126; Cavalleria, 1886/1903,

[11] These words are the Tagalog *yuta* (< Old Malay *yuta*, *djuta* 'one million' < Sanskrit अयुत *ayúta* 'ten thousand,' Tagalog and Maranao *laksa* 'ten thousand' (< Malay *laksa* 'ten thousand' < Sanskrit लक्ष *lakṣa* 'one hundred thousand'), Tagalog *kati* (< Malay *keti* 'one hundred thousand' < Sanskrit कोटि *kōṭi* 'ten million') and Tagalog *bahala* 'ten million; hundred million; inconceivable number' (< Malay *bahara* 'weight' < Sanskrit भार *bhārá* 'burden, load, weight') (Manapat, 2011, pp. 328–332; Verstraelen, 1960, p. 462).

[12] Ziaee (2012, p. 20) argued, "Astrology is prohibited in Islam, and there are many *hadith* from the Prophet (S.A.W.) that denies the relationship between position of stars and the events in our world."

p. 262), a detailed description can be read in the entry *pacutican* and *kotica* in Jacinto Juanmartí's (1892) *Diccionario Moro-Maguindanao-Español*. Here the Jesuit priest defined *pacutican* as a "book that contains figures, and they use these to consult and predict the time to come, as we will say later. Among the many superstitions of the Moros, they are very confused in this one, and with this they show their great ignorance and credulity" (Juanmartí, 1892, p. 88). *Kotica*, then, refers to 'hour, time' (*hora, tiempo*). Juanmartí proceeds to explain the *kotica lima*, or the five divisions of the day which "the Malays and the Moros have." In fact, there are seven divisions (*pito kotica*)[13], but the Maguindanaon "only recognize the influence of their gentile divinities in the first five hours." These five are named after Hindu deities, or in the priest's words, "superstitious deities" (*superticiosas deidades*): Mahesvara, Kala, Sri, Berma, and Bisnu.

Although briefer than Juanmartí's entries, Ferdinand Blumentritt's (1895/1896, pp. 400–401) *Diccionario mitológico de Filipinas* included the said details, referring to the chart as *pakutikan* or *aputikan*. Later in 1919, after reading Blumentritt, A.L. Kroeber (1919, pp. 199–200) mentioned the Maguindanaon *kutika* and its Hindu deities. Blumentritt remarked, "Here we see the most accurate reminiscence of the Hindu era in Philippine history," almost in the same breath as Kroeber who commented, "It is of special interest to find this precise relic of Hindu astronomy maintained among a Mohammedan people. It is likely that

[13]The seven divisions of the day are: (1) Vaktu-ikan, 6:00 - 7:00 am; (2) Vaktu-harimau, 9:00 – 10:00 am; (3) Vaktu-naga, 11:00 – 12:00 nn; (4) Vaktu maotu, 12:00 nn – 1:00 pm, (5) Vaktu asal, or matak in Malay, 3:00 pm; (6) Vaktu lujur, or gajak in Malay, 5:00 pm, and (7) Vaktu-kilala magari, twilight (*Al oscurecese el dia*) (Juanmartí, 1892, p. 88).

the introduction of Arabic writing was the cause of the preservation of the Indian practice." Kroeber is wrong, however, in saying that "these periods… appear to be based on the visible planets." These five names are not planet names in Indian astronomy.[14]

These Sanskrit names identified by Juanmartí, Blumentritt, and Kroeber in the Maguindanaon *kutika* can be compared with those recorded in the Malay *kĕtika* (Wilkinson, 1901, p. 505) and the Bugis *kutika* (Rahmatia & Christomy, 2021). Regarding the Malay *kĕtika*, R.J. Wilkinson provided the two approaches for time divisions: the *kĕtika lima* 'five ominous times' and the *kĕtika tujoh* 'seven ominous times.'

> *K[ĕtika] lima*: "the Five Ominous Times;" divination by dividing the month into periods of five days, and the days into five parts, and then working out the prevailing influence for the critical hour. The dominant influences in this case are the Hindu deities Maheswara (Siva), Vishnu, Sri, Brahma, and Kala, to each of whom a period is allotted.

> *K[ĕtika] tujoh*: "the Seven Ominous Times;" a system of divination by dividing the calendar into periods of seven days and the day into seven parts, and then finding out the dominant influence for the critical period regarding which enquiry is being made. The dominant influences in this case are the Sun and Moon, and the planets Mercury, Mars, Venus, Jupiter and Saturn (Wilkinson, 1901, p. 505).

[14]The planets in Indian astronomy are सूर्य Surya 'Sun,']चन्द्र Chandra or सोम Soma 'Moon,' बुध Budha 'Mercury,' शुक्र Shukra 'Venus,' मङ्गल Mangala 'Mars,' बृहस्पति Brihaspati 'Jupiter,' and शनि Shani 'Saturn.' See Section 3.1.3.4.

Given this information, we can say that the Maguindanaon *kotica* was slightly different from the Malay one, since it has five "special" divisions out of seven, instead of two separate sets of time. More sources, however, may prove if Juanmartí's record is accurate or not. Kroeber's error is also resolved by these Malay entries in Table 4.

Table 4. Hindu Deity Names in Maguindanaon, Bugis, and Malay

Sanskrit	Maguindanaon	Bugis	Malay
महेश्वर Maheśvara	Mahesvara	Masuwara, Masoewara	Maheswara (Siva)
काल Kālá, Kālam	Kala	Kala	Kala
श्री Śrī, Shri	Sri	Siri	S'ri, Sĕri
ब्रह्मा Brahmā	Berma	Barahama	Brahma
विष्णु Viṣṇu, Vishnu	Bisnu	Bisinong	Bisnu, Wisnu, Vishnu

Source: Blumentritt (1895/1896); Juanmartí (1892); Kroeber (1919); Rahmatia and Christomy (2021); Wilkinson (1901).

Contemporary Philippine *kutika* is still in use in Basilan and Tawi-Tawi. Through his fieldwork, Ambrosio learned about the Tawi-Tawi *putikaan*, which he compared to the Panay *signosan* and the Malay *rĕjang* according to time divisions, lunar phenomena, creatures, and geographical features (Ambrosio, 2010, pp. 39, 126–128).[15] Samuel K. Tan and Munap H. Hairulla also translated some Basilan *kutikas* written in Bahasa Sug and Jawi script (Tan & Hairulla, 2007, pp. 33–34, 71–73. 136).

[15]In May 2000, Ambrosio went to Tawi-Tawi to work as a researcher for Samuel K. Tan and Boni Elisa O. Resurreccion's (2000) book, *Tawi-Tawi: The Philippines' Southernmost Frontier*. The book has a section on *putikaan*. See Tan and Resurreccion (2000, p. 105) and Ambrosio (2003).

Going full circle, the word *kutika* and its variations are traceable to Sanskrit. Ambrosio himself rooted *kutika* and *putika* from the Sanskrit घटिका *ghaṭikā*, which he defined as 'a time period with 24 minutes.' *Ghaṭikā* is generally understood as 'time' or 'a period of time,' even extended to 'clock, watch, timepiece, timekeeper,' which can be observed in its descendants like the Hindi and Urdu *ghaṛī* and Bengali *ghôṛi*. For the *Jyotiṣavedāṅga*, "each day is divided into 30 *muhūrtas* or 60 *ghaṭikās*" (Plofker, 2015, p. 1983). The Malay *kĕtika* or *kutika* means 'moment; period of time; epoch; divisions of time with special reference to divination or astrology,' while the *kĕtika rĕjang* refers to 'time according to the *rĕjang*; lucky and unlucky days according to this system of fortune telling' (Wilkinson, 1901, pp. 323, 505). This lexical tracing is further triangulated by the common concern of the Indian *jyotisha* and the Philippine and Indo-Malay *kutika*: astrology and the casting of horoscopes (Dallapiccola, 2002, p. 105).

3.1.3 Astronomical Words Related to Indian-Malay Culture

Other Sanskrit-based words that figured in Philippine astral knowledge and practices can be categorized into the following: (1) deities and spirits, (2) heaven and hell (3) the Milky Way, and (4) eclipse. Implied in these categories is the permeation of Indian-Malay way of life, especially beliefs and religion. Given that the process of Indianization preceded Islamization, we are assuming that the Hindu-Buddhist character of these words and concepts existed first, until it developed into an Islamic one.

With regards to form, we can observe that some of the Philippine borrowings are phonetically closer to the Sanskrit original rather than

the Malay intermediary. This appears in the Maguindanaon *naraka* < Malay *neraka* < Sanskrit *náraka*, *naráka* 'hell' and the Maranao and Maguindanaon *garahana* < Malay *gerhana* < Sanskrit *grahaṇa* 'eclipse.' This phenomenon can be explained by looking at Tagalog borrowings. Regarding this, K. Alexander Adelaar (1994, p. 63) argued, "the fact that Tagalog has often retained a more archaic pronunciation than Malay is not in contradiction with the view that Malay was the vehicular language for the entry of Sanskrit loanwords in Tagalog. It shows that, at the time Malay had a lexical influence on Tagalog, Malay was much more faithful to the original Sanskrit pronunciation than it is now."

3.1.3.1. Deities and Spirits. Sanskrit-based words for deities and spirits has already incurred a lot of discussion (from Blumentritt, 1895/1896, pp. 379–380 to Scott, 1994, pp. 78–81), to the point that some scholars would even argue for a long forgotten "Indianized Philippines" (Churchill, 1977). Nonetheless, these words are relevant to our present topic because they are associated with heaven and other spiritual realms. In the original Sanskrit, देवता *devata* means 'godhead, divinity, deity.' Meaning was retained in Malay, with *dewata* being 'god with high power and position.' However, the case of Cebuano, Hiligaynon, and Tagalog borrowing is strikingly different: it "descends" to the status of 'spirit' (*diwata*), synonymous to *anito* 'spirit; supernatural being' (*Boxer Codex*, 2016, p. 17, 23f, p. 79, 3f; see also Salazar, 1968). During the Spanish *conquista espiritual*, *diwata* (spelled *divata*) was usually equated to 'demon' ("Insurrections by Filipinos in the seventeenth century", 1906, p. 87). A note by Ferdinand Blumentritt (1895/1896, p. 380) further exhibits semantic variation among the Indo-Malay peoples. The word may refer

to: (a) 'supreme being,' like in the Bolaang Mongondow ("Bolaäng-Mongondouers") *Ompu-duata* (lit. 'grandfather diwata'), and the Dayak *djewata* or *djebata*; (b) spirits, like in Javanese *dewata* or *djuwata*; (c) to underworld spirits, like in the Ngaju ("Olo-Ngadju") *djata*; (d) to angels, like in the Makassar-Bugis *rewata* or *dewata*, and the Bantik *mobuduata*; and (e) to ancient spirits, like in Batak *debata idup*.

Unlike *diwata*, the case of *bathala* shows a kind of semantic ascent. In the original Sanskrit, भट्टार *bhaṭṭāra* means 'revered, worshipful,' and by the time it appears in Old Javanese and Malay as *bhaṭāra* and *batara*, it becomes 'god.' According to Blumentritt (1895/1896, p. 370), the Dayak of West Borneo had the term *betara* or *petara* for 'god,' while the Batak of Sumatra and the Makassar and Bugis of Celebes used *batara-guru*, literally 'god-teacher.' For the Tagalogs, Bathala is 'god; the almighty; the maker of all things.'[16] An account on Tagalog beliefs assumes that Bathala's abode is in heaven *Boxer Codex* (2016, p. 79).

3.1.3.2. Heaven and Hell. With regards to 'heaven' as a religious place, it has been shown that some ethnolinguistic groups uninitiated to Islam and Christianity had no heaven-hell equivalents (Ambrosio, 2010, pp. 47–48; Demetrio et al., 1991, pp. 117–119). Rather, their cosmos is usually composed of different layers or covers, with a specific place for people. *Pugaw*, for instance, is the designated homeland, thus the inhabitants of *pugaw* are called *Ifugao*. The Ifugao equivalent for 'heaven' would be *kabunyian*; for the Kankanaey, it also pertains to the supreme

[16] See *Boxer Codex* (2016, p. 63), *Bachtala, napalnanca calgna salabat* [Bathala na may kapangyarihan sa lahat] 'god, the almighty;' de Plasencia (1589/1903, p. 186), *Badhala* as 'all powerful,' or 'maker of all things;' Colín (1663/1906, pp. 69–70), *Bathalang Meycapal*, 'God the Creator or Maker.'

being. What can be considered as "underworld," *dalom*, has no infernal connotations. It is simply located underground (Ambrosio, 2010, pp. 54–57).

Before the Christianized *langit* and *impyerno*,[17] the Hindu-Islamic heaven and hell arrived in the Philippines through Sanskrit-based words. On one hand, स्वर्ग *svargá* 'heaven, paradise; light of heaven; Indra's paradise' (Dallapiccola, 2002, p. 185) becomes *swarga* 'heaven' in Old Javanese, *surga* and *syurga* 'heaven, paradise' in Old Malay, and *syurga*, *sorga*, *surga* and *swarga* 'heaven, paradise' in Malay. Eventually, it became the Maguindanaon *sorga* 'heaven; place of the blessed' (*Compendio y breve vocabulario*, 1888, p. 83; Juanmartí, 1892, p. 207), Maranao *sorga'* 'blessed; the elect; heaven' (McKaughan & Macaraya, 1967, p. 427), Bahasa Sug *sulga'* 'heaven' (Hassan et al., 1975, p. 524), Yakan *sulga'* and *surga'* 'heaven' (Behrens, 2002/2013), Southern Sama (Sama Sibutu) *sulga* 'heaven' (Allison, 1994/2012), and Central Sama/Sinama *sulga'* 'heaven, the abode of God and the angels, and the ultimate destination of the virtuous' ("Central Sinama – English Dictionary", n.d.).[18]

[17] *Langit* can be traced to the PAn *laŋjiC 'sky,' to be later appropriated in the Christian mythology as the abode of God. *Impyerno* is obviously an import, from Spanish *infierno* 'hell,' ultimately from the Latin *infernus* 'of the lower region.'

[18] In 1886, Jesuit Father Pablo Cavalleria wrote in a letter that the Moros of Basilan have "seven heavens and seven hells to express the various rewards or punishments." The seven heavens and the rewards they have are (1) *Yattu Atúan* 'rest,' (2) *Firdéos* 'good things to eat,' (3) *Naím* 'plenty of food,' (4) *Nauá* 'the water here has the taste that one desires,' (5) *Aínum naím* 'great wealth,' (6) *Salsabila* 'golden vessels from which to drink,' and (7) *Jatard al Cots* 'pearls and diamonds.' Father Cavalleria said that "the Moros of the interior of the island are called Yácanes [Yakan], and are employed, although but little, in the cultivation of palay, sweet-potatoes, cacao, etc.," while "the Moros of the coast are called Sámales Laút [Sama Dilaut]. They are employed, although little, in fishing… [t]hey are pirates." He added, "Among the Sámales Laút, there are Joloan Moros, and Malays" (Cavalleria, 1886/1903, pp. 255–256, 262–263).

On the other hand, the Sanskrit नरक *náraka*, *naráka* 'hell' (Dallapiccola, 2002, p. 143) was borrowed by Old Javanese and Malay as *naraka* and *neraka*, respectively, with the same meaning, 'hell.' It entered Maguindanaon as *naraka* 'hell, place of the condemned,' Maranao, Bahasa Sug, and Yakan as *narka'* 'hell,' Southern Sama (Sama Sibutu) as *nalkah* 'hell,' and Central Sama/Sinama as *nalka'* 'hell, the place where the wicked are sent in the afterworld' (Allison, 1994/2012; Behrens, 2002/2013; "Central Sinama – English Dictionary", n.d.; Hassan et al., 1975, p. 524; Juanmartí, 1892, p. 144; McKaughan & Macaraya, 1967, p. 269; cf. *neraka*, *naruk* in Ambrosio, 2010, p. 39; Cavalleria, 1886/1903, p. 263).[19] *Naraka'* in Maranao means 'sinner; cursed of God; nefarious' (McKaughan & Macaraya, 1967, p. 268).[20] An 1886 account about the Basilan Moros, which were either the Yácanes (Yakan) or the Sámales Laút (Sama Laut/ Sama Dilaut/ Badjao/ Bajau Laut), mentioned that they have seven hells (*naruk*) which contain varying punishments (Cavalleria, 1886/1903, p. 263).[21]

[19]There is also *jahannam* in Central Sama/Sinama, which means 'Gehenna, a division of hell' ("Central Sinama – English Dictionary", n.d.). *Gehenna* is based on the Hebrew word *Gehinnom*, or the Valley of Hinnom, which can be considered as 'hell' or 'place of divine punishment' in the Jewish religious tradition.

[20]I used apostrophe ['] instead of [ʔ] to refer to glottal stop, in order to maintain the orthographic practice of Ambrosio (2010) and other dictionaries (e.g. Hassan et al., 1975; "Central Sinama – English Dictionary", n.d.). In their 1967 dictionary, McKaughan and Macaraya used [q] to denote glottal stop (see p. viii); in the subsequent versions of the dictionary (1996 and 2012), apostrophe ['] is used.

[21]These are (1) *Naruk Yahanna* ("here [there is] confusion"), (2) *Naruk Sacar* ("[here there are] contrivances and animals for inflicting torture"), (3) *Naruk Sigmilti* ("[here there are] tortures in language"), (4) *Naruk abus* ("[here there are] most ugly things"), (5) *Naruk Jauya* ("here one is run through with spears"), (6) *Naruk Zaalt* ("here one suffers thirst"), and (7) *Naruk Jamia* ("here one is tortured with fire") (cf. footnote 18).

With these, we assume that there was a remarkable shift from the Hindu concept to Islamic. In Bahasa Sug and Yakan, hell is also called *jahannam*, after the Arabic جَهَنَّم *jahannam*. In Bahasa Sug, it specifically refers to 'a division in hell in which the most severe punishment is given; also an evil-minded person' (Hassan et al., 1975, p. 315). In Yakan, Dietlinde Behrens (2002/2013) noted that the compound word *narka' jahannam* 'the fiery pit of hell' is thought to be "more severe than just *narka*'." Recorded in 1886, one of the seven hells for Basilan Moros is the *Naruk Yahanna*, wherein people would suffer through "confusion" (Cavalleria, 1886/1903, p. 263). The pre-existence of these religious concepts among Mindanao and Sulu communities would help the Spanish missionaries in relaying the Christian idea of heaven and hell. In a Maguindanaon wordlist, *su languit* 'sky' (*el cielo*) is differentiated from *su sorga* 'heaven' (*la gloria*) (*Compendio y breve vocabulario*, 1888, p. 83).

3.1.3.3. The Milky Way. Bahasa Sug, Mapun, and Sama, languages spoken in the Sulu Archipelago, have the word *naga*, which pertains not only to 'snake' or 'dragon' ("Mapun Dictionary", 2019; Hassan et al., 1975, p. 417), but also to 'Milky Way' (Ambrosio, 2010, pp. 145–148). To add, *mala a naga* is the Maranao Milky Way (McKaughan & Macaraya, 1967, p. 236; Ambrosio, 2010, p. 147). A similar case appears among the Bugis, whose term *bintoeng nagae* 'the dragon' refers to the Milky Way (Ammarell, 2008, p. 330). The Philippine *naga* is probably borrowed from Malay *naga* 'dragon,' as seen not only in the nagas of Bahasa Sug, Mapun, and Sama, but also in Maguindanaon *naga* 'dragon or mythical serpent' (Juanmartí, 1892, p. 142), Maranao *naga* 'dragon' (McKaughan & Macaraya, 1967, p. 266) Yakan *naga* 'dragon' (Behrens, 2002/2013),

and Southern Sama (Sama Sibutu) *naga* 'dragon' (Allison, 1994/2012). A Central Sama/Sinama dictionary defines *naga* as 'a mythical dragon which is said to swallow the moon during an eclipse, but which can be compelled to disgorge it by the beating of gongs; a snake spirit which may locate itself in a human body and bring about the ill health and ultimately the death of his nearest relatives' ("Central Sinama – English Dictionary", n.d.). According to Blumentritt (1895/1896, p. 420; see also Ambrosio, 2010, p. 146), the Teduray ascribe *naga* to a large, eight-headed fish that lives in the middle of the sea. Further, Blumentritt's note on the Batak, Ngaju, and Dayak describes their nagas, *naga-padoha*, *naga-galang-pelak*, and *naga-pusah*, respectively, as a giant creature that causes earthquake (Blumentritt, 1895/1896, pp. 420–421; see also Ambrosio, 2010, p. 146). Ultimately, these words are from the Sanskrit नाग *nāgá*, also *nagi* or *nagini* 'snake, serpent,' prominently known in Hindu, Buddhist, and Jaina mythology and folklore as half-human, half-snake, semi-divine beings (Dallapiccola, 2002, pp. 139–140). It is worth noting that although Maguindanaon has *naga* 'dragon or mythical serpent,' it has a different equivalent for Milky Way: *Lalan*, *Lalan isumesen sa Alungan*, or *Lalan na Langaw* (Ambrosio, 2010, p. 183; *Compendio y breve vocabulario*, 1888, p. 84; Juanmartí, 1892, p. 28).

3.1.3.4. Eclipse. Two words from Sanskrit are associated with eclipse: *grahaṇa* and *rahu*. On one hand, ग्रहण *grahaṇa* 'eclipse' made its way to Javanese and Malay through *grahana* and *gerhana*, respectively, and later to Maguindanaon and Maranao, with *garahana* 'eclipse' (Ambrosio, 2010, p. 39; *Compendio y breve vocabulario*, 1888, p. 85; McKaughan & Macaraya, 1967, p. 111).

On the other hand, the Tagalog *laho*, Kapampangan *lawo*, Bahasa Sug *lahu'* and Sama *lahu'* and *lahuh* are probably borrowed from the Malay *rahu*, which ultimately descended from the Sanskrit राहु *Rāhu*. In Hinduism, Rāhu is one of the *ashura* ('demon') who represents the solar eclipse and the ascending lunar node, partnered with केतु Ketu who embodies the lunar eclipse and the descending lunar node. Rāhu and Ketu are two of the *navagrahas* (nine planets) of the Indian astronomy, the others being सूर्य Surya (Sun), चन्द्र Chandra or सोम Soma (Moon), बुध Budha (Mercury), शुक्र Shukra (Venus), मङ्गल Mangala (Mars), बृहस्पति Brihaspati (Jupiter), and शनि Shani (Saturn) (Dallapiccola, 2002, pp. 144–145). However, when these proper names were received by Javanese and Malay, and later by Philippine languages, they attained new meanings. Thus, *Rahu* ceased to be a name for an ashura that causes the solar eclipse. When ancient Tagalogs spoke of it, it was a "monster" or a giant serpent that devours the sun or moon (Ambrosio, 2010, pp. 39, 137–138; Blumentritt, 1895/1896, p. 402). Its Bisayan counterpart could be the *bakunawa* 'bent snake' (Mojares, 2013, pp. 87–88; Porras, 1919), or the Central Sama/Sinama *naga*, as mentioned earlier. Later, the Tagalog word simply refers to the eclipse, as seen also in the Kapampangan *lawo* 'the darkening of the moon in an eclipse,' Bahasa Sug *lahu'* 'eclipse of the sun or moon,' and Central Sama/Sinama *lahu'* 'an eclipse; eclipsed, of sun or moon' (Bergaño, 1732/2007, p. 210; "Central Sinama – English Dictionary", n.d.; Hassan et al., 1975, p. 337). Nonetheless, the Tagalog *laho* denotes an act of disappearance.

This semantic change in Tagalog—from sun/moon-eating creature to an astronomical phenomenon—also appears in Southern Sama (Sama Sibutu). *Lahuh* initially refers to 'a monster which eats the moon or sun

during eclipses.' Presently, as K.J. Allison (1994/2012) notes, *lahuh* is used only in idiomatic phrases which are the "Sama way[s] of expressing eclipse." These include *kakan lahuh bulan* 'lunar eclipse' (lit. 'monster eating the moon') and *kakan lahuh llow* 'solar eclipse' (lit. 'monster eating the sun').

Given this Sanskrit-Malay contribution to Philippine astronomical knowledge and practices, we can now discuss another layer to the paradigm: the Arabic-Malay.

3.2 Arabic-Malay

The general term for 'knowledge, science' in Arabic is *ʕilm* عِلْم (plural: عُلُوم *ʕulūm*). Like the Latin *scientia* in its 14th century context (see Williams, 1976, pp. 215–218), *ʕilm* "could be knowledge of the natural world, as well as knowledge of religion and other things" (Masood, 2009, p. xxi). Equivalent to astral science are varied extensions of *ʕilm*: فَلَك *falak* 'orbit; sphere; sky; outer space; universe; heaven; orb; circulation,' نُجُوم *nujūm* (singular: نَجْم *najm*) 'celestial bodies; stars; planets; luminaries,' and تَنْجِيم *tanjīm* 'astrology,' derived from نَجَّمَ *najjama* 'to observe the stars; to predict future from the stars; to practice astrology.' In varying contexts, Islamic astral science is referred to as *ʿilm al-nujūm* (Schmidl, 2022, p. 252), *ʕilm al-falak* (Ziaee, 2012, pp. 20–21), or *ilmu falak* (Ma'u, 2019, p. 91). With نجم *necm* (plural: نجوم *necum*) derived from the Arabic *najm* and *nujūm*, the Ottomans used *ilm ul nucum* 'knowledge of stars' and *ilmu akvami nucum* 'astrology' (Ozcep, 2020). Later, Ottoman scientists would use another word that approximates a modern meaning, an *ilm* that is based on "reason, experiment, and evidence"— *fenn* (plural:

fünûn) 'tools; techniques' (Martykánová, 2020; Masood, 2009, p. xxi; Ozcep, 2020).

ʕIlm sailed to the Malay world and became *'ilmu* 'knowledge, science; divination, sorcery.' R.J. Wilkinson's Malay dictionary provides the term *'ilmu bintang* 'astronomy,' along with *'ilmu hitongan* and *'ilmu kira-kira* 'arithmetic,' *'ilmu hikmat* 'a magic art of any sort; magical practices,' *mĕmbuwat 'ilmu* 'the practice of black art,' and *bĕr'ilmu* 'wise; learned; erudite' (Wilkinson, 1901, p. 438). The journeying word was warmly embraced by the preconquest Filipinos, leading to the existence of Tagalog *alam* 'to know; known' (Baklanova, 2017, p. 38; Potet, 2014, p. 132), Maguindanaon *ilmu* 'science' (Juanmartí, 1892, p. 72), Maranao *alim* 'expert; sage; philosopher; religious authority' and *ka'alim* 'science; knowledge; education' (McKaughan & Macaraya, 1967, pp. 11, 145), Mapun *alim* 'man who has lots of religious knowledge' ("Mapun Dictionary", 2019), Yakan *alim* and *ālim* 'a person gifted with second sight; a seer' (Behrens, 2002/2013), Bahasa Sug *ilmu'* 'esoteric, magical, or supernatural knowledge' (Hassan et al., 1975, p. 300), Central Sama/Sinama *ilmu'* 'esoteric or magical knowledge; power from a supernatural source' ("Central Sinama – English Dictionary", n.d.), and Southern Sama (Sama Sibutu) *ilmuh* 'religion; knowledge of magic rituals; secret formulas; magic spells; occult knowledge' (Allison, 1994/2012).

Since no equivalent Arabic-based Philippine term for 'astronomy' or 'astrology' has been found yet, we are led to subsume this 'science of stars' among these Arabic-based terms for knowledge and science. In fact, like Malay, terms under *ilmu* in Juanmartí's Maguindanaon dictionary are highly suggestive of semantic extensions: *ilmu illahi* 'the science of god;

theology,' *ilmu cambilang* 'the science of counting; arithmetic,' and *ilmu bayug* 'poetry' (Juanmartí, 1892, p. 72).

As implied above, obvious candidates for finding Arabic-Malay astronomical words are those languages whose speakers were Islamized. With the exception of prehispanic Islamized Tagalogs, these speakers mainly resided in the Philippine South, belonging to the following ethnolinguistic groups: Tausug, Sama, Badjao, Yakan, Jama Mapun, Molbog, Palawan, Kalibugan, Kalagan, Sangil, Iranun, Maranao, and Maguindanao (Donoso, 2013). These Islamized groups are further differentiated into various communities or states, interacting with each other or with the non-Islamized Lumad groups (Rodil, 2017). The languages they spoke more likely retained, if not recontextualized, some enduring Sanskrit-Malay words. A historiographical problem, however, arises here. Except for the Tagalog region, most of these Muslim communities in the Philippine South resisted Spanish colonialism. It was only in the 19th century when a higher degree of intrusion in Mindanao was achieved, mainly through the Jesuit policy of attraction accompanied by Spanish offensives. By the early 20th century, after an initial peace time, Sulu would be brutally pacified by the new colonizer, the United States, as seen in the Battles of Bud Dajo (1907) and Bud Bagsak (1913) in the highlands of Jolo.

In relation to our present task, the most documented Muslim ethnolinguistic group in late 19th century is Maguindanao, whose heartland is at the Pulangi River Valley. Here was born the Maguindanao Sultanate of 1515, founded by Sharif Kabungsuwan. In the 19th century, as observed by the Jesuits, Maguindanaon language acted as a lingua franca, spoken not only by the Maguindanao but also by their Teduray neighbors (Arcilla,

2000). The extent of Maguindanaon documentation in the 19th century can be inferred through two books which are extensively cited here: *Compendio y breve vocabulario* (1888), by a Jesuit missionary ("un padre missionero de la Compañia de Jesus"), and Jacinto Juanmartí's (1892) two-part *Diccionario Moro-Maguindanao-Español*. Historian Isagani R. Medina (2005, p. 65) posits that the *Compendio y breve vocabulario* was written by the same priest, Juanmartí, despite authorial anonymity. Serving as the local superior from 1874 till his death in 1897, Juanmartí (1832-1897) was instrumental for the Rio de Grande mission centered in Tamontaka, Cotabato (now in Cotabato City). Juxtaposed to these accessible sources are the language manuscripts on "Lutao" (Sama) and Maranao that are yet to be found and consulted (Medina, 2005, pp. 61–62).

For this section, we are looking mainly at the (1) Arabic-Malay words that entered Philippine astronomy. Given the astronomical foundation set by Austronesian through basic words, to be coupled with expansions through Sanskrit-Malay, the Arabic novelty is apparent in the borrowing of planet names. Along with these Arabic-based planet names are the appearance of (2) Malay-based words, specifically those referring to star categories, and (3) words that hinted European contact.

3.2.1 Arabic-based Planet Names

The *Compendio y breve vocabulario* (1888, p. 84) includes planet names that are ultimately from Arabic, except Hertsel (Uranus) (Table 5). Moreover, the case of the Maguindanaon *duña* 'earth' (*Compendio y breve vocabulario*, 1888, p. 83) exhibits closer affinity to Arabic-Malay (*dunia* 'earth' < Arabic دُنْيَا *dunyā*, 'lower place, world') rather than Sanskrit-

Malay (*bumi* 'earth' < Sanskrit भूमि *bhūmi* 'earth') (Wilkinson, 1901, p. 300). Unlike Sanskrit-Malay, Arabic-Malay was able to secure an imprint in Philippine astronomy through this Maguindanaon borrowing of planet names. It also serves as evidence of the entry of modern astronomical ideas. The inclusion of Hertsel (Uranus) is striking, as well as the arrangement of planets that implies a heliocentric model. This suggests that the Maguindanaon speakers were already knowledgeable of a planetary system, probably even a sun-centered one, before the entry of Western astronomy either through the Spanish or American colonizers.

Table 5. Arabic-based Maguindanaon and Malay Planets

Maguindanaon	Malay	Arabic	Equivalent
Utarid	*Utarid*	العطارد *al-'Utarid*	Mercury
Zahrat	*Zuhrah*	الزهرة *al-Zuhara*	Venus
Marik	*Marikh*	المرّيخ *al-Marrikh*	Mars
Mustari	Musytari	المشتري *al-Mushtari*	Jupiter
Zajal	*Zuhal*	الزحل *al-Zuhal*	Saturn
Hertsel	*Uranus*	القرح *al-Quzah*	Uranus

Source: *Compendio y breve vocabulario* (1888, p. 84); Wilkinson (1901).

A curious entry, however, appears in Juanmartí's (1892, p. 184) dictionary.

> RAJA – Star – The seven stars that, according to the Moros, exert their influence on the twenty-four hours of the day, and are the following: The Sun, the Moon, Jupiter, Mars, Venus, Mercury and the Earth.

> RAJA – Bintang – Los siete astros que, según los moros ejercen su influencia sobre las veinte y cuatro horas del día, y son los siguientes: El Sol, la Luna, Júpiter, Marte, Venus, Mercurio y la Tierra.

Raja 'lord, ruler' is clearly Sanskrit-based, although it has been incorporated into the Sulu and Maguindanao sultanates for specific positions such as *rajah muda* ('young lord:' prince or heir), and *rajah laut* ('sea lord:' admiral) (Scott, 1994, p. 176). Here, *raja*, as a kind of 'ruling *bintang*,' is comprised of a seven-bodied planetary system. This can be compared to the Malay *kětika tujoh*, although in this case, the Maguindanaon had no Saturn; instead, they had Earth.

Nonetheless, the significance of the Arabic-based planet borrowings can be further assessed in light of Ambrosio's observation. He stated that, "It appears that the Filipinos, both past and present, do not recognize planets as 'wandering stars.' They treat the planets Venus and Jupiter as either morning or evening stars. They do not differentiate the two, nor do they treat them as a phenomenon apart from that of a star" (Ambrosio, 2010, p. 185). In similar vein, Blust et al. (2023) pointed out in the Ifugao *bitúwon* 'star' that it is "also planet since the Ifugao do not distinguish between the two." With this they define *talló* not only as 'bright morning or evening star' but also 'the planet Venus.' Such conflation of stars and planets has been pointed out by colonial observers, like Juan de Plasencia, who wrote in 1589 that the "some of [the Tagalogs] also adored the stars, although they did not know them by their names, as the Spaniards and other nations know the planets—with the one exception of the morning star, which they called Tala" (de Plasencia, 1589/1903, pp. 188–189). Other ethnolinguistic groups have more specific

star names, which correspond to the planets Venus, Mars, Jupiter, and Saturn (Table 6).[22]

Table 6. Planets and Local Equivalents

Planet	Local equivalent
Venus	Tagalog: *Tanglao Daga* Tagalog: *Tanglao Daga* Ibaloi: *Mamawas* Kankanaey: *Batakagan* Kankanaey: *Bitakagan* Ifugao: *Talló*, also 'bright evening or morning star' Bisayan: *Macadadamlag* Sama/Bahasa Sug: *Lakag* Sama/Bahasa Sug: *Maga*, also 'morning star'

[22]Ambrosio (1999, pp. 90–91) explained why names overlap in the specific case of Tawi-Tawi stars/planets: "there are two more lone stars identified by the people of Tawi-Tawi: the Tunggal Bahangi, the evening star, and the Lakag or Maga, the morning star. According to Jamrun, the Mapun people call the morning star Kababbasan and the evening star Kababbasan madusta. Last April, it was Venus that Indalhati and Hadji Hamad identified as Tunggal Bahangi, which appeared then in the west from twilight till nine o'clock in the evening. Hadji Hamad also called it Duga-Duga. Meanwhile, it was Jupiter that was identified as Lakag or Maga, which appeared then in the east before dawn… If to be studied carefully, one can say that what are referred to as Tunggal Bahangi and Lakag are not fixed. It can be Venus, Mars, Jupiter, and Saturn, depending on seasonal positions. These are the only bright 'stars' that can appear near the east before the sun rises or near the west before the sun sets. Venus is often identified as Tunggal Bahangi or Lakag because it is the only one among the four big 'stars' that frequents these positions. Venus does not veer away from the sun, thus it only changes position in the east and west. Mars, Jupiter, and Saturn's orbits are distant from the sun, thus they can reach the zenith and be seen the whole nighttime unlike Venus."

Planet	Local equivalent
	Sama/Bahasa Sug: *Duga-Duga* Sama/Bahasa Sug: *Tunggal Bahangi* Palawan: *Antatala* Palawan: *Buntatala*
Mars	Sama/Bahasa Sug: *Lakag* Sama/Bahasa Sug: *Tunggal Bahangi*
Jupiter	Ibaloi: *Mamawas* Sama/Bahasa Sug: *Lakag* Sama/Bahasa Sug: *Maga*, also 'morning star' Sama/Bahasa Sug: *Tunggal Bahangi* Palawan: *Anak Datu*
Saturn	Palawan: *Anak Datu*

Source: Ambrosio (1999) and Ambrosio (2010); Blust et al. (2023); Hassan et al. (1975); Ramos (2022).

3.2.2 Malay-based Star Categories

Aside from Arabic-Malay planet names, the *Compendio y breve vocabulario* also included words for comet (*bituun bericor-berasap*), fixed star (*bituun tatap*), and planets (*bituun beridar*). Shown here is how Maguindanaon maintained the use of *bituun* (from PAn *bituqen 'star'), followed by Malay-based words that served to extend the star meaning. Thus, the Maguindanaon comet is literally a 'star with tail' or 'smoking star,' fixed star a 'gazing or watching star,' and planet a 'revolving star.' Although Maguindanaon uses *bituun* as base word for these astro-

nomical concepts, Juanmartí's (1892, p. 27) dictionary also included the Malay-based *bintang* 'star.'

For comet, the practice of extending the star meaning is also apparent in other languages (Table 7). In Tagalog, comets are called *bituing may sombol* 'star with a pennant' (Noceda & de Sanlucar, 1832, p. 375). Due to this parallelism, as well as the assumed experience that the passing of comets, like meteors and shooting stars, can be seen by naked eye, we may say that identifying and naming comets is most probably a premodern practice. The case is different for fixed stars and planets, because they reflect an already proto-modern or modern concept. Fixed stars and planets are present in astronomical texts, from Ptolemy's *Almagest* to Copernicus' *De revolutionibus*. The word planet, in fact, is derived from the Ancient Greek πλάνητες ἀστέρες *plánētes astéres*, 'wandering stars.' To introduce the idea of 'wandering' or movement is to distinguish this kind of 'stars' from fixed stars. Therefore, *bituun tatap* and *bituun beridar* recorded in a 19thcentury text signals a Maguindanaon reception of a proto-modern or modern astronomical concept.

Table 7. Comet, Fixed Star, and Planet in Maguindanaon

Astronomical body or phenomenon	Maguindanaon	Possible root
comet (*cometa*)	*bituun bericor-berasap*	*bituun* < PAn *bituqen 'star' *bericor* < Malay *ékor* 'tail' / Old Javanese *ikū*, *ikuh* 'tail' < PAn *ikuR 'tail'

Astronomical body or phenomenon	Maguindanaon	Possible root
		berasap < Malay *bĕrasap* 'to be smoking—as embers; to be covered with vapour—as a mountain summit' < Malay *asap* 'visible vapor; steam; smoke' / Old Javanese *asep* incense < PWMP *asep 'incense, ritual smoke' (cf. Malay *bintang bĕrekor*, *bintang bĕrasap*, 'comet')
fixed star (*estrella fija*)	*bituun tatap*	*bituun* < PAn *bituqen 'star' *tatap* < Malay *tatap* 'careful visual examination; the act of looking over anything with a view to finding flaws or deficiencies, if any; watching, looking out' (cf. Malay *bĕrtatap*, *menatap* 'to watch, to gaze')
planet (*planeta*)	*bituun beridar*	*bituun* < PAn *bituqen 'star'

Astronomical body or phenomenon	Maguindanaon	Possible root
		beridar < Malay *bĕridar* 'revolving' < Malay *idar*, *edar* 'change of position; revolution; circulation; rotation; movement' (cf. Malay *bintang bĕridar* 'wandering star, planet')

Source: Blust et al. (2023); *Compendio y breve vocabulario* (1888); Wilkinson (1901).

3.2.3 Clues of European Contact

The *Compendio y breve vocabulario* and Juanmartí's Maguindanaon dictionary also hinted European contact. We can identify two words related to astronomy. First, already mentioned earlier, is *Hertsel*, the Maguindanaon equivalent for Uranus. It is named after Sir William Herschel (1738-1822), a German-born British astronomer who discovered the planet in March 1781 (see Knickerbocker, 1927, pp. 109–121; Wolf, 1961, pp. 113–120). Two years after the discovery, Herschel gave the name *Georgium sidus* (George's star) in honor of King George III, but it did not gain popularity outside Britain and Herschel's hometown, Hanover. Rather, other astronomers, such as the French, used the name *Herschel*. In 1782, German astronomer Johann Elert Bode proposed the name Uranus, after the Greek titan, and by 1850 it was established as the international name. How Herschel became the Maguindanaon *Hertsel* is yet to be known. Given that there is an Arabic Uranus, القزح *al-Quzah*, it seems that the Maguindanaon borrowing might have come ultimately

from a European source, and such an epistemic lag was maintained until the time of Juanmartí's record. A parallel case can be found in Hawaiian, which uses the Herschel-derived *Hereekela* or *Heleekela* for planet Uranus (Andrews, 1865, p. 159; Andrews, 1922, p. 120; Pukui & Elbert, 1986, p. 65).

The other word is *bituun bacá* or simply *bacá*, pertaining to the constellation Taurus (Juanmartí, 1892, pp. 16, 28). Under the entry for *bituun* 'star,' this is grouped with *Utara* or *Bituun-Vtara* (Polaris), *Guiubar* (Orion), *Bintang-biduc*, *Bituun-Biduc* or *Biduc* (Ursa Major), *Langau* or *Cartica-Langau* (Pleiades), *Macabengas* or *Macabengas-Timor* (morning star), *Mascarumi* or *Mascarumi-Petang* (afternoon star), *Lalan* or *Lalan isumesen sa Alungan* (Milky Way), and the already mentioned *bituun tatap*, *beridar*, and *bericor y berasap* (Juanmartí, 1892, p. 28; see also Ambrosio, 2010, pp. 164, 168, 183; *Compendio y breve vocabulario*, 1888, p. 84).[23]

Bacá might be borrowed either from Spanish or Portuguese *vaca* 'cow,' inherited from the Latin *vacca*.[24] *Baca* as solely Taurus, and not as cow, is implied by the entries *sapi a babay* 'female cattle' and *bacá* 'beard, jaw' (*la barba, quijada*) in Juanmartí's (1892, pp. 16, 197) dictionary. *Sapi* in Malay pertains to 'a cow or ox' (Wilkinson, 1901, p. 362).

[23]Ambrosio speculates that *Tatap* is "'fox star' (?)" (2010, p. 183). I am not sure what he meant, but perhaps this can be clarified by the Malay *tatap* 'careful visual examination; the act of looking over anything with a view to finding flaws or deficiencies, if any; watching, looking out,' more so by the *Compendio y breve vocabulario*'s (1888) identification of *bituun tatap* as 'fixed star' (*estrella fija*). Therefore, it is not a star name but rather a category. *Tatap* as a separate entry is also absent in Juanmartí's dictionary.

[24]For parallel cases, see the Tagalog borrowings *banyaga* 'foreigner' (< Malay *běniaga* 'trade' < Indo-Portuguese *veniaga* 'merchant, merchandise') and *linggo* 'Sunday, week' (< Malay *minggu* 'Sunday, week' < Portuguese *domingo* 'Sunday') (Wolff, 1976, p. 351).

However, this proposed Spanish or Portuguese rooting of Maguindanaon *baka* may still be challenged by the fact that the Teduray and the Bukidnon also have *Baka* constellations. The Teduray see *baka* as jaw of a wild boar. In Maranao, *baka?* (spelled *baka'* or *bakaq*) pertains either to 'star indicating right time for slash and burn method' or to 'chin' (McKaughan & Macaraya, 1967, pp. 36–37; see also Ambrosio, 2010, p. 183). Is the starry image of 'jaw' or 'chin'—instead of the foreign 'cow'—the unifying thread for Maguindanaon, Maranao, and Teduray? The Teduray *Baka*'s equivalent is the Hyades, seen as part of Taurus (Ambrosio, 2010, pp. 173–174).[25] Basing on the ethnographic study of Fay-Cooper Cole, Ambrosio (2010, p. 174) presumed that *Baka* is also the Hyades for Bukidnon.[26] Nonetheless, by the 20th century, Tagalog vernacularists would use *Damulag* for Taurus (see Ignacio, 1921; Lopez, 1963), while the Bisayans and Ilokanos would retain the Spanish *Tauro* (see Alfar, 1950/1965; Guirnalda, n.d.; Porras, 1919).

[25]In Teduray myths, Baka is one of the adopted children of Keluguy, whose nickname is Fegeferafad. The other two kids are Baka's cousins, Kufukufu and Seretar. Fegeferafad corresponds to a part of the Canis Major, Canis Minor and Gemini; Kufukufu, also meaning 'flies,' to Pleiades; and Seretar, the warrior, to a part of Orion (Ambrosio, 2010, pp. 173–174).

[26]Given this, we can think of two scenarios. First, if *baka* came from Maguindanaon (whether from another source like Spanish/Portuguese or not), their Teduray neighbors would have adopted it; their fellow Muslims, the Maranao, might have borrowed it too, further relaying it to the Bukidnon. Second, if *baka* is not from Maguindanaon, it might have come from foreign or non-foreign sources, like Teduray, Bukidnon, or Maranao.

4 Conclusion

As historian Nicholas Tarling (1966) wrote, "If up to the turn of the fifteenth century, the major population movements were overland, outside influences, perhaps even migrations were reaching Southeast Asia by sea, placed as it was at the confluence of world routes," we are left to think, as this paper nears its conclusion, that the phrase "sea unites and mountains divide" (McFarland, 1994, p. 76) has been best reflected by this history of Philippine proto-modern astronomy. We are left, moreover, to imagine that as Sanskrit and Arabic astronomical words sailed to the Malay world and eventually to the Philippine communities, transporting new scientific ideas and practices, they were, in turn, guided by the stars.

In sum, the paper examines the Philippine reception of foreign astronomical knowledge and practices before the advent of Euro-American colonialism. We have identified first the Austronesian paradigm which served as the foundation of astronomical knowledge. By so doing, we are able to recognize the latter additions, marked by Sanskrit-Arabic influences through Malay. The basic astronomical words are Austronesian: words for sky or heaven, sun, moon, star, and meteors. Sanskrit-Arabic-Malay words reflect new concepts and methods. New concepts are usually expansions of precedent glosses: 'star' is further qualified as 'smoking star' and 'star with a tail' (comet), 'watching star' (fixed star), or 'moving star' (planet), and 'heaven' expands its religious meaning, resulting to a counterpart, 'hell.' New methods connote socio-economic concerns, if not novel ways to read the world: dating a debt receipt renders reliability, daytime deity names amplify astrological authority,

and words for measurement and calculation inform us about the ones who count and the ones being counted.

We have strongly emphasized the role of Malay mediation in relaying these foreign astronomical knowledge and practices. Though Indian and Islamic astronomy had already achieved their golden ages by the 16th century—the time of European encounter in these islands— we cannot say yet that these innovations had been received and used *in the same form* by Philippine communities. The decision to appreciate (and to appropriate, however devoid of original context) rests more on the side of receivers of knowledge, rather than donors.

Thus, as recommendation for future research, the existence of Sanskrit-Arabic-Malay astronomical words in Philippine languages needs to be further scrutinized. Through this paper, we have discussed language contact through the borrowings of astronomical words. But how salient, really, were these words? In what specific ways were they utilized by precolonial Filipinos, vis-à-vis by their neighbors in the Indo-Malay Archipelago, and even in the larger region of Southeast Asia and the Pacific? The Jesuit documentation of Arabic-based planets in 19th century Maguindanaon is a notable feat, but we do not know yet how significant these terms were, or how were they subjected to local understanding or use. More detailed historical sources and ethnographic accounts would help resolve these issues.

From the 16th to the 19th century, as Spanish colonialism gradually "reduced" Philippine communities, we might think that astronomical proto-modernity would eventually "mature" (see Hook, 2002), leading to its modern phase. Spanish contribution, in fact, can be seen in the Alfonsine Tables; further, in the 17th century, the Council of the

Indies had a specific office for a cosmographer-professor whose task was to document eclipses, compile sea and land routes, and teach mathematics and science subjects (*Recopilación de leyes de los reinos de las Indias*, 1791, pp. 320–322). Despite these innovations, the Philippine case shows a slow process towards astronomical modernity. Aside from geographical distance, semi-independence of colonial administration, missionary priorities, and native resistance, the epistemic lag could also be blamed to the Spaniards themselves, who, knowing the conflict surrounding heliocentrism in Europe, would have perpetuated the delay of this scientific revolution. In 1616, books advocating for heliocentrism, such as Copernicus' *De revolutionibus* and In *Job commentaria* by Diego de Zúñiga of Salamanca, were banned by the Roman Inquisition (Finocchiaro, 1989, pp. 148–159). Citing Owen Gingerich, Resil B. Mojares (2013, p. 411) told that "only two Asian countries possessed the 1543 edition [of Copernicus' *De revolutionibus*], Japan and the Philippines, where a copy exists in the University of Santo Tomas. It is likely that Santo Tomas acquired the copy when its library was first established in 1605, but we have no information on its use." As far as available sources are concerned, it was only in the 19th century that pupils would read textbooks that discuss the Copernican solar system (e.g. de Rueda, 1845; Noval, 1896). Such development in colonial education can be coupled with the establishment of scientific institutions during Spain's last century in the islands. Within Jesuit auspices, the Observatorio del Ateneo Municipal was born in 1865, later reorganized as Observatorio Meteorológico de Manila in 1884 (see Alvarez, 2014; Anduaga, 2017). Through the observatory, the Jesuits ventured into as-

tronomical studies, culminating in the establishment of its astronomical branch during a star-spangled year, 1899.

5 References

Adelaar, K. Alexander. (1994). Malay and Javanese loanwords in Malagasy, Tagalog and Siraya (Formosa). *Bijdragen tot de Taal-, Land- en Volkenkunde*, *Deel 150* (1ste Afl.), 50–66.

Adelaar, K. Alexander, Prentice, David John, Grijns, Cornelis Dirk, Steinhauer, Hein, & van Engelenhoven, Aone. (1996). Malay: Its history, role and spread. In Stephen A. Wurm, Peter. Mühlhäusler, & Darrell T. Tyron (Eds.), *Atlas of languages of international communication in the Pacific, Asia, and the Americas* (pp. 673–694). De Gruyter Mouton.

Alcina, Francisco Ignacio. (2005). *History of the Bisayan people in the Philippine Islands* (Vol. part 1, book 3, vol. 3) [Kobak, Cantius J. and Gutiérrez Lucio (Trans., Eds., Annot.)]. University of Santo Tomas Publishing House. (Original work published 1668)

Alfar, Brigido B. (1965). *Karaang napta sumala sa sugid sa karaang mga tawo*. The House of Magno. (Original work published 1950)

Allison, Karen J. (Comp.) (2012). Sama Sibutu dictionary [web edition, Summer Institute of Linguistics Philippines]. https://philippines.sil.org/resources/works_in_progress/ssb.

Alvarez, Kerby C. (2014). *Observatorio de Manila: Institusyong pang-agham at ang ambag nito sa pagsusulong ng meteorolohiya sa Pilipinas, 1865-1933* [Unpublished master's thesis]. Departamento ng Kasaysayan, University of the Philippines Diliman.

Ambrosio, Dante L. (1994). Astronomya sa Pilipinas: Mga bituin, mga alamat. *Diliman Review*, *42*(2), 44–49.

Ambrosio, Dante L. (1996). Wika, astronomya, kultura: Kulturang Pilipino sa mga katawagang astronomiko. In Pamela C. Constantino & Monico M. Atienza (Eds.), *Mga piling diskurso sa wika at lipunan* (pp. 279–290). University of the Philippines Press.

Ambrosio, Dante L. (1999). Mamahi: Mga bituin ng Tawi-Tawi. *ADHIKA*, *1*, 67–110.

Ambrosio, Dante L. (2003). *Balatik: Kalangitan bilang isang saligan ng kabihasnan Pilipino, 1582-kasalukuyan* [Doctoral dissertation]. Departamento ng Kasaysayan, University of the Philippines Diliman.

Ambrosio, Dante L. (2005). Balatik: Katutubong bituin ng mga Pilipino. *Philippine Social Sciences Review*, *57*(1-4), 1–28.

Ambrosio, Dante L. (2006). Kabilugan at katunawan: Buwan sa kabihasnang Filipino. *Daluyan: Journal ng Wikang Filipino*, *13*(1-2), 87–101.

Ambrosio, Dante L. (2010). *Balatik: Etnoastronomiya: Kalangitan sa kabihasnang Pilipino*. University of the Philippines Press.

Ammarell, Gene. (2008). Astronomy in the Indo-Malay Archipelago. In Helaine Selin (Ed.), *Encyclopaedia of the history of science, technology, and medicine in Non-Western cultures* (pp. 324–333). Springer.

Andrews, Lorrin. (1865). *A dictionary of the Hawaiian language*. Henry M. Whitney.

Andrews, Lorrin. (1922). *A dictionary of the Hawaiian language*. Board of Commissioners of Public Archives.

Anduaga, Aitor. (2017). *Cyclones and earthquakes: The Jesuits, prediction, trade, and Spanish dominion in Cuba and the Philippines, 1850-1898*. Ateneo de Manila University Press.

Arcilla, José S. (2000). *Jesuit missionary letters from Mindanao (volume 1): The Rio Grande mission* (José S. Arcilla, Ed.) [Trans., Annot.]. University of the Philippines Center for Integrative; Development Studies, National Historical Institute, University of the Philippines Press, the Archives of the Philippine Province of the Society of Jesus.

Baklanova, Ekaterina. (2017). Types of borrowings in Tagalog/Filipino. *Kritika Kultura*, *28*, 35–54.

Barra, Bea Rose P., Olayres Jr., Mario D., & Quinto, Allerah Mejan C. (2023). Above us, only sky: A reconstruction of some astronomical and meteorological terms in Pre-Ibaloi. *UP Working Papers in Linguistics*, *2*(1), 63–92.

Behrens, Dietlinde (Comp.) (2013). Yakan-English dictionary [web edition, Summer Institute of Linguistics Philippines]. https://philippines.sil.org/resources/online_resources/yka.

Bellwood, Peter. (2017). *First islanders: Prehistory and human migration in island Southeast Asia*. John Wiley Sons, Inc.

Bellwood, Peter, Chambers, Geoffrey, Ross, Malcom, & Hung, Hsiao-chun. (2011). Are 'cultures' inherited? multidisciplinary perspectives on the origins and migrations of Austronesian-speaking peoples prior to 1000 bc. In Benjamin W. Roberts & Marc Vander Linden Linden (Eds.), *Investigating archaeological cul-*

tures: Material culture, variability, and transmission (pp. 321–354). Springer.

Bergaño, Diego. (2007). *Vocabulario de pampango en romance y diccionario de romance en pampango* (Venancio Q. Samson, Trans.). Holy Angel University Press. (Original work published 1732)

Blake, Stephen P. (2016). *Astronomy and astrology in the Islamic world*. Edinburgh University Press.

Blumentritt, Ferdinand. (1896). Diccionario mitológico de Filipinas. In Wenceslao E. Retana (Ed.), *Archivo del bibliófilo filipino: Recopilación de documentos históricos, científicos, literarios y políticos y estudios bibliográficos* (pp. 335–454, Vol. 2). (Original work published 1895)

Blust, Robert. (2019a). The Austronesian homeland and dispersal. *Annual Review of Linguistics*, *5*, 417–434.

Blust, Robert. (2019b). The resurrection of Proto-Philippines. *Oceanic Linguistics*, *58*(2), 153–256.

Blust, Robert. (2020). Response to comments on "The Resurrection of Proto-Philippines". *Oceanic Linguistics*, *59*(1/2), 450–479.

Blust, Robert, Trussel, Stephen, Smith, Alexander D., & Forkel, Robert. (2023). The Austronesian Comparative Dictionary Online. https://acd.clld.org/.

Boxer Codex [Isaac Donoso (Transcr., Ed), Ma. Luisa Garcia, Carlos Quirino and Mauro Garcia (Trans., Annot.) (Original work written ca. 1574-1591)]. (2016). Vibal Foundation Inc.

Butterfield, Herbert. (1962). *The origins of modern science 1300-1800*. The Free Press.

Cavalleria, Pablo. (1903). Letter from Father Pablo Cavalleria to Father Francisco Sanchez. In Emma Helen Blair & James Alexander Robertson (Eds.), *The Philippine Islands 1493-1898* (pp. 255–267, Vol. XLIII – 1670–1700). The Arthur H. Clark Company. (Original work published 1886)

Central Sinama – English dictionary. (n.d.). https://philippines.sil.org/resources/works_in_progress/sml.

Chapman, Allan. (2018). *Comets, cosmology, and the big bang: A history of astronomy from Edmond Halley to Edwin Hubble 1700-2000*. Lion Hudson Limited.

Churchill, Malcolm H. (1977). Indian penetration of Pre-Spanish Philippines: A new look at the evidence. *Asian Studies*, *15*, 21–45.

Clavé, Elsa, & Griffiths, Arlo. (2022). The Laguna Copperplate Inscription: Tenth century Luzon, Java, and the Malay world. *Philippine Studies: Historical and Ethnographic Viewpoints*, *70*(2), 167–242.

Coedès, George. (1968). *The Indianized states of Southeast Asia* (Walter F. Vella & Sue Brown Cowing, Trans.). University of Hawaii Press.

Colín, Francisco. (1906). Native races and their customs. In Emma Helen Blair & James Alexander Robertson (Eds.), *The Philippine Islands 1493-1898* (pp. 37–98, Vol. XL – 1690–1691). The Arthur H. Clark Company. (Original work published 1663)

Compendio de historia universal desde la creacion del mundo hasta la venida de jesucristo y breve vocabulario en Castellano y Moro-Maguindanao. (1888). Imprenta de Koh Yew Hean.

Copernicus, Nicolaus. (1952). *On the revolutions of the heavenly spheres* (Charles Glenn Wallis, Trans.). Encyclopaedia Britannica, Inc. (Original work published 1543)

Dallapiccola, Anna L. (2002). *Dictionary of Hindu lore and legend*. Thames Hudson, Ltd.

de Plasencia, Juan. (1903). Customs of the Tagalogs. In Emma Helen Blair & James Alexander Robertson (Eds.), *The Philippine Islands 1493-1898* (pp. 173–196, Vol. VII – 1588–1591). The Arthur H. Clark Company. (Original work published 1589)

de Rueda, Ricardo. (1845). *La escuela de instrucción primaria o colección de todas las materias que comprende la primera enseñanza conforme al plan vigente*. Imprenta de la Viuda de Roldan.

Demetrio, Francisco R., Cordero-Fernando, Gilda, Zialcita, Fernando N., & Feleo, Roberto B. (1991). *The soul book*. GCF Books.

Donoso, Isaac J. (2013). *Islamic Far East: Ethnogenesis of Philippine Islam*. University of the Philippines Press.

Finocchiaro, Maurice A. (Ed.). (1989). *The Galileo affair: A documentary history*. University of California Press.

Fong, Jimmy B. (Ed.). (2021). *Mga kuwentong-bayan ng Timog Cordillera*. Komisyon sa Wikang Filipino.

Foucault, Michel. (2003). *Society must be defended: Lectures at the Collège de France, 1975-76* (Mauro Bertani & Alessandro Fontana, Eds.; David Macey, Trans.). Picador.

Galilei, Galileo. (1967). *Dialogue concerning the two chief world systems—Ptolemaic and Copernican* (Stillman Drake, Trans.; 2nd). University of California Press. (Original work published 1632)

Gallego, Maria Kristina S. (2018). Directional systems in Philippine languages. *Oceanic Linguistics*, *57* (1), 63–100.

Gingerich, Owen. (1986). Islamic astronomy. *Scientific American*, *254* (4), 74–83.

Guillermo, Ramon. (2009). Mga suliranin sa proyekto ng maugnaying Pilipino. In Galileo S. Zafra (Ed.), *Salin-suri: Panimulang pagmamapa ng mga larangan ng pag-aaral ng pagsasalin sa Pilipinas: Ikatlong sourcebook ng SANGFI* (pp. 263–276). UP Sentro ng Wikang Filipino – Diliman, Sanggunian sa Filipino, Pambansang Komisyon para sa Kultura at mga Sining.

Guirnalda, Fernando. (n.d.). *Planetario wenno pangkitaan iti cababalin dagiti tattao a mayanac a gapuanan ti opanagleggac dagiti nadumaduma a planeta*.

Hassan, Irene, Halud, Nurhadan, Ashley, Seymour, & Ashley, Lois. (1975). *Tausug-English dictionary: Kabtangan iban maana*. Summer Institute of Linguistics.

Heidarzadeh, Tofigh. (2015). Islamic astronomical instruments and observatories. In Clive L.N. Ruggles (Ed.), *Handbook of archaeoastronomy and ethnoastronomy* (pp. 1917–1926). Springer.

Hidayat, Bambang. (2000). Indo-Malay astronomy. In Helaine Selin & Sun Xiaochun (Eds.), *Astronomy across cultures: The history of Non-Western astronomy, 1* (pp. 371–384). Springer.

Hook, Ernest B. (Ed.). (2002). *Prematurity in scientific discovery: On resistance and neglect*. University of California Press.

Ignacio, Rosendo. (1921). *Aklat ng karununĝan ó mga lihim ng kalikasan: Sinipi sa mga "Libro de Ciencias"*. Imp. "Lus Naciente".

Insurrections by Filipinos in the seventeenth century. (1906). In Emma Helen Blair & James Alexander Robertson (Eds.), *The Philippine Islands 1493-1898* (pp. 87–240, Vol. XXXVIII – 1674–1683). The Arthur H. Clark Company.

Juanmartí, Jacinto. (1892). *Diccionario moro-maguindanao-español*. Tipografía "Amigo del País".

Knickerbocker, William S. (Ed.). (1927). *Classics of modern science*. F.S. Crofts, Inc./ Beacon Press.

Kroeber, Alfred Louis. (1919). *Peoples of the Philippines*. American Museum of Natural History.

Kuhn, Thomas S. (1957). *The Copernican revolution: Planetary astronomy in the development of Western thought*. Vintage Books.

Kuhn, Thomas S. (1962). *The structure of scientific revolutions*. The University of Chicago Press.

Liao, Hsiu-chuan. (2020). A reply to Blust (2019) "The Resurrection of Proto-Philippines". *Oceanic Linguistics*, *59*(1/2), 426–449.

Lopez, Honorio M. (1963). *Lunario ng kapalaran sa pagaasawa at paghanap ng mapalad na makakasama*. Lopez Publication.

Majul, Cesar Adib. (1976). An historical background on the coming and spread of Islam and Christianity in Southeast Asia. *Asian Studies*, *14*, 1–14.

Manapat, Ricardo. (2011). Mathematical ideas in early Philippine society. *Philippine Studies*, *59*, 291–336.

Mapun dictionary. (2019). https://www.webonary.org/mapun/.

Martykánová, Darina. (2020). Science and technology in the Ottoman language of power (1790s-1910s). Rethinking the state, the econ-

omy, and the elites. *European Journal of Turkish Studies*, *31*. https ://doi.org/https://journals.openedition.org/ejts/6937.

Masood, Ehsan. (2009). *Science and Islam: A history*. Icon Books Ltd.

Ma'u, Dahlia Haliah. (2019). The history and development of Islamic astronomy in Indonesia. *Malaysian Journal of Syariah and Law*, *7*(2), 91–100.

McFarland, Curtis D. (1994). Subgrouping and number of the Philippine languages: Or how many Philippine languages are there? *Philippine Journal of Linguistics*, *25*(1-2), 75–84.

McKaughan, Howard P., & Macaraya, Batua A. (Comp.) (1967). *A Maranao dictionary*. University of Hawaii Press.

Medina, Isagani R. (2005). Vocabularios y diccionarios in the major and minor Philippine languages: Lasting legacies of the Church in the Philippines (1565-1898). In *Dila ng bayan* (pp. 1–88). National Comission on Culture; the Arts.

Mojares, Resil B. (1997). *House of memory*. Anvil Publishing, Inc.

Mojares, Resil B. (2013). *Isabelo's archive*. Anvil Publishing, Inc.

Noceda, Juan, & de Sanlucar, Pedro. (1832). *Vocabulario de la lengua tagala*. Imprenta de Higinio Roldan.

Noval, José. (1896). *Lecciones de geografía universal y particular de España y Filipinas*. Imprenta del Colegio de Sto. Tomás.

Ôhashi, Yukio. (2015). Astronomy of the Vedic age. In C.L.N. Ruggles (Ed.), *Handbook of archaeoastronomy and ethnoastronomy* (pp. 1949–1958). Springer.

Ostler, Nicholas. (2005). *Empires of the word: A language history of the world*. HarperCollins Publishers.

Ozcep, Ferhat. (2020). Physical earth and its sciences in Istanbul: A journey from pre-modern (Islamic) to modern times. *History of Geo- and Space Sciences*, *11*, 173–198.

Pingree, David. (1973). The Greek influence on early Islamic mathematical astronomy. *Journal of the American Oriental Society*, *93*(1), 32–43.

Plofker, Kim. (2015). Mathematical astronomy in India. In C.L.N. Ruggles (Ed.), *Handbook of archaeoastronomy and ethnoastronomy* (pp. 1981–1989). Springer.

Porras, Mansueto. (1919). *Signosan: Nativitate domine nostri jesuchriste*. La Panayana.

Postma, Antoon (Bapa) (Comp.) (2005). *Kultura Mangyan, 2*. Mangyan Heritage Center.

Potet, Jean-Paul G. (2014). *Arabic and Persian loanwords in Tagalog*. Lulu Press.

Ptolemy. (1952). *The Almagest* (R. Catesby Taliaferro, Trans.) [Originally published ca. 150 CE]. Encyclopaedia Britannica, Inc.

Pukui, Maru Kawena, & Elbert, Samuel H. (1986). *Hawaiian dictionary*. University of Hawaii Press.

Rahmatia & Christomy, Tommy. (2021). Sufism on the Buginese Kutika manuscripts: Tracing the influence of Sufi order in South Sulawesi XIX century [European Union Digital Library, 12 January.]. *Proceedings of the 4th BASA: International Seminar on Recent Language, Literature and Local Culture Studies*. https://eudl.eu/doi/10.4108/eai.4-11-2020.2314152.

Ramos, Valerio P. (2022). *Kankanaey dictionary*.

Recopilación de leyes de los reinos de las Indias. (1791). La Viuda de D. Joaquin Ibarra.

Reichenbach, Hans. (1962). *The rise of scientific philosophy*. University of California Press.

Reid, Lawrence A. (1982). The demise of Proto-Philippines. In Amran Halim, Lois Carrington, & Stephen A. Wurm (Eds.), *Papers from the Third International Conference on Austronesian Linguistics* (pp. 201–216, Vol. 2, Tracking the travellers). Pacific Linguistics.

Reid, Lawrence A. (2020). Response to Blust "The Resurrection of Proto-Philippines". *Oceanic Linguistics*, *59*(1/2), 374–393.

Rizal, José. (2010). *Correspondence with Blumentritt* (Vol. 1). National Historical Comission of the Philippines.

Rodil, Rudy B. (2017). *Kasaysayan ng mga pamayanan ng Mindanao at Arkipelago ng Sulu 1596-1898*. Komisyon sa Wikang Filipino.

Ross, Malcolm. (2020). Comment on Blust "The Resurrection of Proto-Philippines". *Oceanic Linguistics*, *59*(1/2), 366–373.

Salazar, Zeus A. (1968). Footnote to Dr. Francisco's 'notes' on Tavera. *Asian Studies*, *6*(3), 431–444.

Saleeby, Najeeb M. (1908). *The history of Sulu*. Bureau of Printing.

Saliba, George. (1982). The development of astronomy in Medieval Islamic Society. *Arab Studies Quarterly*, *4*(3), 211–225.

Saliba, George. (1992). The role of the astrologer in medieval Islamic society. *Bulletin d'études Orientales*, *44*, 45–67.

Saliba, George. (2002). Greek astronomy and the medieval Arabic tradition: The medieval Islamic astronomers were not merely translators. they may also have played a key role in the Copernican revolution. *American Scientist*, *90*(4), 360–367.

Santos, Hector. (1996). The date of the Laguna Copperplate Inscription. *Philippine Studies*, *44* (4), 514–525.

SarDesai, Damodar R. (2013). *Southeast Asia: Past and present*. Westview Press.

Schmidl, Petra G. (2015). Islamic folk astronomy. In Clive L.N. Ruggles (Ed.), *Handbook of archaeoastronomy and ethnoastronomy* (pp. 1927–1934). Springer.

Schmidl, Petra G. (2022). Al-Ashraf ʿUmar's Tabṣira: Chapter xxxiv. Rainbows, shooting stars, and haloes as signs of the future. In Klaus Herbers & Hans-Christian Lehner Lehner (Eds.), *Dreams, nature, and practices as signs of the future in the Middle Ages* (pp. 252–309). Brill.

Scott, William Henry. (1984). *Prehispanic source materials for the study of Philippine history*. New Day Publishers.

Scott, William Henry. (1994). *Barangay: Sixteenth-century Philippine culture and society*. Ateneo de Manila University Press.

Smith, Alexander D. (2017). The Western Malayo-Polynesian problem. *Oceanic Linguistics*, *56*, 435–490.

Tan, Samuel K., & Hairulla, Munap H. (2007). *Jawi documentary series no. 4: Basilan Kitabs*. UP Center for Integrative; Development Studies.

Tan, Samuel K., & Resurreccion, Bona Elisa O. (2000). *Tawi-Tawi: The Philippines' southernmost frontier*. Sahaya Development Center Foundation, Inc.

Tarling, Nicholas. (1966). *A concise history of Southeast Asia*. Praeger.

Verstraelen, Eugene. (1960). An essay towards a historical description of Tagalog and Cebuano Bisaya. *Philippine Studies*, *8*(3), 491–514.

Walicek, Don E. (2007). Chinese Spanish in 19th-century Cuba: Documenting sociohistorical context. In Magnus Huber & Viveka Velupillai (Eds.), *Synchronic and diachronic perspectives on contact languages* (pp. 297–324). John Benjamins Publishing Company.

Whitehead, Alfred North. (1925). *Science and the modern world*. The Free Press.

Wilkinson, Richard James. (1901). *A Malay-English dictionary*. Kelly; Walsh Limited.

Williams, Raymond. (1976). *Keywords: A vocabulary of culture and society*. Oxford University Press.

Wolf, Abraham. (1961). *A history of science, technology, and philosophy in the 18th century* (Vol. 1). Harper Torchbooks.

Wolff, John U. (1976). Malay borrowings in Tagalog. In C.D. Cowan & O.W. Wolters (Eds.), *Southeast-Asian history and historiography: Essays presented to D.G.H. Hall* (pp. 345–367). Cornell University Press.

Wolff, John U. (2014). *Dictionary of Cebuano Visayan* (web, J. Hellingman). http://www.bohol.ph/wced.php. (Original work published 1972)

Wrigglesworth, Hazel J. (Ed.). (1991). *The maiden of many nations: The skymaiden who married a man from earth*. Linguistic Society of the Philippines.

Ziaee, Ali Akbar. (2012). *Islamic sciences: Astronomy, cosmology and geometry: Ibrahim Hakki's Marifetnāme*. Amin Research; Cultural Centre.

Zorc, R. David. (1982). Micro- and macro-subgrouping: Criteria, problems, and procedures. In Rainer Carle, Martine Heinschke, Peter W. Pink, Christel Rost, & Karen Stadtlander (Eds.), *Gava: Studies in Austronesian languages and culture* (pp. 305–320). Dietrich Reimer Verlag.

Zorc, R. David. (1993). The prehistory and origin of the Tagalog people. In Otto Dahl (Ed.), *Language – a doorway between human cultures: Tributes to Dr. Otto Chr. Dahl on his ninetieth birthday* (pp. 1–11). Novus Porlag.

Zorc, R. David. (2020). Reactions to Blust's "The Resurrection of Proto-Philippines". *Oceanic Linguistics*, *59*(1/2), 394–425.

Zorc, R. David, & Almarines, April. (2021). Axis relationships in the Philippines: When traditional subgrouping falls short. *The Archive, Special Publication*, *17*, 1–112.

6 Appendix

Austronesian Astronomical Words

Collated here are the Austronesian astronomical words that constitute the following reconstructions: PAn *laŋjiC 'sky, heaven,' PAn *qajaw 'day, sun,' PMP *qalejaw 'day, sun,' PAn *bulaN 'moon,' PAn *bituqen 'star,' PMP *talaq$_1$ 'star,' PPh *bulalákaw$_2$ 'meteor, shooting star,' PPh *dúlis 'meteor, shooting star,' and PPh *dúlit 'meteor, shooting star.' Data are derived from Robert Blust, Stephen Trussel, Alexander D. Smith, and Robert Forkel's (2023) The Austronesian Comparative Dictionary (ACD), except for Table 4, Eastern Mindanao Axis *ʔandaw 'day,' which is proposed by R. David Zorc (Zorc & Almarines, 2021). As told earlier, words are provided as they are presented in the ACD. ACD has its own limitations, from the expected accuracy of orthography to the range of meanings. Future acquisition of additional data, through archival or field work, would help in nuancing the reconstructions and entries.

Table 1. Proto-Austronesian *laŋjiC 'sky'

Proto-form	Language	Reflex
Proto-Austronesian *laŋjiC 'sky' (PMP *laŋit: WMP, CMP, SHWNG; see also PWMP *laŋit 'palate; canopy')	Itbayaten	*xañit* 'heaven, sky'
	Ilokano	*láŋit* 'sky, heaven'
		i-láŋit 'to raise to the sky, lift up toward heaven'
		maŋ-láŋit 'to daydream'
	Ibanag	*láŋiʔ* 'sky'
	Isneg	*láŋit* 'heavens, sky'

Proto-form	Language	Reflex
	Isneg	*i-láŋit* 'spirits of the sky' (usually favorable to reapers; when they want to possess a shaman they use a bridge or ladder to come down)
	Itawis	*láŋit* 'sky'
	Gaddang	*láŋit* 'sky'
	Casiguran Dumagat	*laŋet* 'sky, heaven' (thought of as a huge, round, blue dome which is cupped over the earth)
	Agta (Dupaningan)	*láŋet* 'sky'
	Ifugaw	*laŋít* 'heaven, skyworld;' currently used by the Ifugaw, but borrowed from Ilokano or other languages
	Ifugaw (Batad)	*lāŋit* 'heaven'
	Ibaloy	*daŋit* 'heaven'
	Sambal (Botolan)	*láŋit* 'sky'
	Umiray Dumaget	*laŋot* 'sky'
	Tagalog	*láŋit* 'sky' *taga-láŋit* 'heavenly, of or in heaven'
	Bikol	*láŋit* 'sky, heavens' *ka-laŋít-an* 'the heavens' *laŋít-non* 'heavenly, celestial'
	Masbatenyo	*láŋit* 'sky, heaven, firmament, atmosphere'

Proto-form	Language	Reflex
	Aklanon	*eáŋit* 'sky, heaven' *ka-eaŋít-an* 'the heavens, Heaven'
	Waray-Waray	*láŋit* 'sky, space, heaven, eternity'
	Hiligaynon	*láŋit* 'heaven, sky, outer space'
	Cebuano	*láŋit* 'heaven, sky, joy, happiness'
	Mansaka	*laŋit* 'heaven, sky'
	Tausug	*laŋit* 'the sky'
	Hanunóo	*láŋit* 'sky, heavens'
	Palawan Batak	*laŋít* 'sky, heavens'
	Molbog	*laŋit* 'sky'
	Maranao	*laŋit* 'sky, heaven'
	Binukid	*laŋit* 'sky, heaven'
	Manobo (Tigwa)	*laŋit* 'sky'
	Tboli	*loŋit* 'sky, heaven'
	Mapun	*laŋit* 'the sky'
	Yakan	*laŋit* 'sky'

Source: Blust et al. (2023), ACD, https://acd.clld.org/cognatesets/30407#2/-8.8/173.5.

Table 2. Proto-Malayo-Polynesian *qalejaw 'day'

Proto-form	Language	Reflexes
Proto-Malayo-Polynesian *qalejaw 'day' (doublet: *qajaw) WMP, CMP; Zorc: PPh *qaljaw;	Itbayaten	*araw* 'sun'
	Ilokano	*aldáw* 'day'
	Isneg	*alxáw* 'day'
	Itawis	*álgaw* 'day'
	Casiguran Dumagat	*aldew* 'day, daytime'

Proto-form	Language	Reflexes
see also PMP *qalejaw-qalejaw 'daily, every day;' PWMP *maŋ-qalejaw; PWMP *paŋ-qalejaw-an; PPh *ka-qalejaw-an; PPh *qalejaw-an 'place in the sun')	Malaweg	*álgaw* 'day'
	Kalinga (Guinaang)	*algáw* 'day'
	Bontok	*ʔalgów* 'sun'
	Kankanaey	*ágew* 'sun, day, daytime, daylight, light, sweat, perspiration'
	Ifugaw	*algó* 'sun, day'
	Ifugaw (Batad)	*algaw* 'do something all day long; to sun something or someone'
	Kapampangan	*aldo* 'sun, day'
	Ayta Maganchi	*allo* 'day, sun'
	Remontado	*aydáw* 'day'
	Tagalog	*áraw* 'sun, day'
	Bikol	*alláw* 'day'
	Aklanon	*ádlaw* 'day, sun'
	Cebuano	*adláw* 'sun, day,' 'day' (as opposed to night)
	Hanunóo	*ʔáldaw* 'tomorrow'
	Palawan Batak	*ʔalláw* 'sun,' 'day' (opposite of night, rather than time measure)
	Klata	*oddow* 'day'
	Tboli	*kedaw* 'sun, day'

Source: Blust et al. (2023), ACD, https://acd.clld.org/cognatesets/30407#2/-8.8/173.5.

Table 3. Proto-Austronesian *qajaw 'day' and *q<um>ajaw to shine (of the sun)

Proto-form	Language	Reflexes
Proto-Austronesian *qajaw 'day' (doublet: *qalejaw)	Ifugaw	*um-algó* 'to shine (of the sun)'
*q<um>ajaw 'to shine (of the sun)' (Formosan, WMP; see also POc *qaco 'day,' doublet: *$qalo_1$; PAn *ma-qajaw 'sunny, hot')	Manobo (Western Bukidnon)	*andew* 'of the weather, to be sunny, day, sun'

Source: Blust et al. (2023), ACD, https://acd.clld.org/cognatesets/30407#2/-8.8/173.5.

Table 4. EMn-axis *ʔandaw 'day'

Proto-form	Language	Reflexes
Eastern Mindanao Axis *ʔandaw 'day' (nasal cluster introduced to PPh *qaljaw)	Manobo (Western Bukidnon)	*andew* 'of the weather, to be sunny, day, sun'
	Manobo (Ilianon)	*ʔandəw* 'day'
		ʔəndəw 'day'
	Central Subanen	*gindaw 'day'
	Western Subanen	*gondow 'day'
	Maranao	*daondao* 'day'

Source: see Zorc and Almarines (2021, p. 20).

Table 5. Proto-Austronesian *bulaN 'moon, month; menstruation'

Proto-form	Language	Reflexes
Proto-Austronesian *bulaN 'moon, month; menstruation' (PMP *bulan$_3$; POc *pulan$_3$; see also PMP *bulan-bulan$_2$ 'each month, every month, monthly; for months' PMP *bulan matay 'new moon, eclipse' (lit. 'dead moon'); PWMP *bulan-an 'monthly,' by the month; PWMP *bulan-en 'affected by the moon, mentally or emotionally unstable;' PWMP *bulan bulan-en 'affected by the moon, mentally or emotionally unstable;' PWMP *b<um>ulan 'walk in the moonlight;' PWMP *sakit bulan 'menses, menstruation;' PWMP *sa-ŋa-bulan 'one month (in duration);' PPh *ka-bulan-an 'month of expected childbirth')	Itbayaten	*voxan* 'moon, month'
	Ilokano	*búlan* 'moon, month, menses'
	Isneg	*búlan* 'moon, month'
	Itawis	*húlan* 'moon, month'
	Casiguran Dumagat	*bulán* 'moon, month' *me-mulan* 'to hunt by moonlight'
	Kalinga (Guinaang)	*bulán* 'moon'
	Bontok	*búlan* 'moon, month'
	Kankanaey	*búan* 'moon, moonlight, month'
	Ifugaw	*búlan* 'moon, lunar month, month'
	Ifugaw (Batad)	*būlan* 'moon'
	Pangasinan	*bolán* 'moon, month'
	Kapampangan	*bulan* 'moon, month'
	Tagalog	*buán* 'month, moon'
	Bikol	*búlan* 'moon, month'
	Bantuqanon	*bulan* 'moon'
	Aklanon	*búean* 'moon, month' *b-in-úean* 'monthly'
	Hiligaynon	*búlan* 'moon, month'
	Cebuano	*búlan* 'moon, month' *b-in-úlan* 'once a month, monthly' *b-in-ulan-án* 'household help'

Proto-form	Language	Reflexes
		pa-búlan 'hire oneself, someone out as a servant'
	Mansaka	*boran* 'moon, month'
	Hanunóo	*búlan* 'moon, month'
	Palawan Batak	*bulán* 'moon'
	Molbog	*bulan* 'moon'
	Binukid	*bulan* 'moon, month'
	Manobo (Western Bukidnon)	*bulan* 'month, moon, menstruate'
	Maranao	*olan* 'moon, month, pregnancy duration'
		olan-a? 'moonlight night'
		bolan 'month'
	Inati	*bolan* 'moon'
	Tiruray	*bulon* 'moon'
	Klata	*bula* 'moon'
	Tboli	*bulon* 'moon, month'

Source: Blust et al. (2023), ACD, https://acd.clld.org/cognatesets/30407#2/-8.8/173.5.

Table 6. Proto-Austronesian *bituqen 'star'

Proto-form	Language	Reflexes
Proto-Austronesian *bituqen 'star' (doublet: PMP *bituqin) (Formosan, WMP, CMP, SHWNG)	Itbayaten	*vitoen* 'star'
		vitwen 'star'
	Ivatan (Isamorong)	*vitohen* 'star'
	Ivatan	*vitohen* 'star'
	Ilokano	*bituén* 'star'
		bituén baybáy 'starfish'

Proto-form	Language	Reflexes
	Isneg	*bittuwán* 'star'
	Casiguran Dumagat	*bitón* 'star; for the stars to come out after a rain shower'
	Ifugaw	*bitúwon* 'star;' also 'planet' since the Ifugaw do not distinguish between the two. All the stars are believed to be the daughters of the moon deity.
	Ifugaw (Batad)	*bittūan* 'be starry, of the sky; a star'
	Pangasinan	*bitéwen, bitúen* 'star'
	Kapampangan	*batwín* 'star'
	Tagalog	*bitú?in* 'star'
	Bikol	*bitú?on* 'star in the sky'
	Bantuqanon	*bitu?on* 'star'
	Aklanon	*bitú?on* 'star (general term)'
	Hiligaynon	*bitú?un* 'star'
	Cebuano	*bitú?un* 'star; kind of tree of strand, the star-shaped fruits of which are used as fish poison: *Barringtonia asiatica*'
		bitú?un sa dagat 'starfish'
	Mansaka	*bitoon* 'be starry (of the sky)'

Proto-form	Language	Reflexes
	Manobo (Western Bukidnon)	*bitu?en* 'star'
	Binukid	*bituen* 'star'
	Maranao	*bito?on* 'star'
	Kalamian Tagbanwa	*bitukun* star

Source: see Blust et al. (2023), ACD, https://acd.clld.org/cognatesets/30407#2/-8.8/173.5.

Table 7. Proto-Malayo-Polynesian *talaq$_1$ 'the morning (evening) star: Venus'

Proto-form	Language	Reflexes
Proto-Malayo-Polynesian *talaq$_1$ 'the morning (evening) star: Venus' (doublet: *mantalaq)	Ifugaw	*talló* 'bright morning or evening star, the planet Venus'
	Tagalog	*tála?* 'bright star, planet'
	Mansaka	*bonta-tara?* 'morning star'

Source: see Blust et al. (2023), ACD, https://acd.clld.org/cognatesets/30407#2/-8.8/173.5.

Table 8. Proto-Philippine *bulalákaw$_2$ 'shooting star, meteor, spirit of the shooting star'

Proto-form	Language	Reflexes
Proto-Philippine *bulalákaw$_2$ 'shooting star, meteor, spirit of the shooting star'	Ilokano	*bullaláyaw* 'rainbow'
	Bontok	*bolláyaw* 'shooting star, meteorite.' It is believed to be a spirit.

Proto-form	Language	Reflexes
	Kankanaey	*bulalákaw* 'kind of animal (?), supposed to be an old eel, to fly and to be luminous.' Many stories are told about it.
	Ifugaw	*bulalákaw* 'whiteness of a wealthy young man;' used in hudhúd literature; *bulákaw* 'whiteness of a wealthy young man;' used in hudhúd literature; *bulaláyu* 'meteor, shooting star'
	Ifugaw (Batad)	*bullāyaw* 'a fireball with a tail; comet' (tradition is that it eats and drinks the blood of a person at night who is not protected by a fire)
	Kapampangan	*bulalakaw* 'exclamation uttered when seeing a shooting star'
	Tagalog	*bulalákaw* 'shooting star, meteor, St. Elmo's fire'
	Bikol	*bulalákaw* 'meteor, shooting star'
	Aklanon	*bulalákaw* 'bird, believed to be carrier of evil spirits'

Proto-form	Language	Reflexes
	Cebuano	*bulákaw* 'harmful supernatural being that takes the form of a ball of fire with trailing sparks. If it brushes or gets close enough to smell the skin it makes a permanent white spot; ball of fire used as transportation for *úŋlu?* (witch);' *bulalákaw* 'shooting star'
	Hanunóo	*bulalákaw* 'any large meteorite, or falling star'
	Palawan Batak	*bulalakaw* 'nature spirit, deity; spirit of shooting star'
	Binukid	*bulalakaw* 'spirit deity believed to inhabit and guard rivers' (synonym *tala-wahig*)
	Manobo (Western Bukidnon)	*bulelakaw* 'spirit deity of streams and lakes'
	Maranao	*bolalakaw* 'craze, madness, insanity (caused by evil spirit); spirit, god of the fish'
	Kalamian Tagbanwa	*bulalakaw* 'shooting star'

Source: see Blust et al. (2023), ACD, https://acd.clld.org/cognatesets/30407#2/-8.8/173.5.

Table 9. Proto-Philippine *dúlis and *dúlit 'shooting star, meteor'

Proto-form	Language	Reflexes
Proto-Philippine *dúlis 'shooting star, meteor' (disjunct: *dúlit)	Aklanon	*dúlis* 'shooting star'
*dúlit 'shooting star, meteor' (disjunct: *dúlis)	Isneg	*dúlit* 'shooting star'
	Hanunóo	*dúlit* 'a very small meteorite, or falling star'

Source: see Blust et al. (2023), ACD, https://acd.clld.org/cognatesets/30407#2/-8.8/173.5.

Acknowledgements

The present article is partly derived, with major revisions, from the first chapter of my MA History thesis, *Filipino Reception and Appropriation of Modern Astronomical Knowledge, 1859-1958* (Departamento ng Kasaysayan, University of the Philippines Diliman, 2024). The thesis benefitted from the UP Diliman Creative/Critical Thesis Grant in the Arts, Culture and Humanities (UPD-CCTGACH), and this being the case, I am acknowledging the Office of the Chancellor of the University of the Philippines Diliman, through the Office of Initiatives in Culture and Arts, for the funding support. I would like to thank my thesis advisers, reader, and critic, Prof. Maria Bernadette L. Abrera, Prof. Ros A. Costelo, Prof. Percival F. Almoro, and Prof. Jesus Federico C. Hernandez, respectively, and the editor of this issue, Prof. Maria Kristina S. Gallego, and the two anonymous reviewers, for their insights, comments, and encouragement. Lastly, I am deeply grateful to Vincci Santiago, without whose guidance and friendship this essay wouldn't even see the light of day.