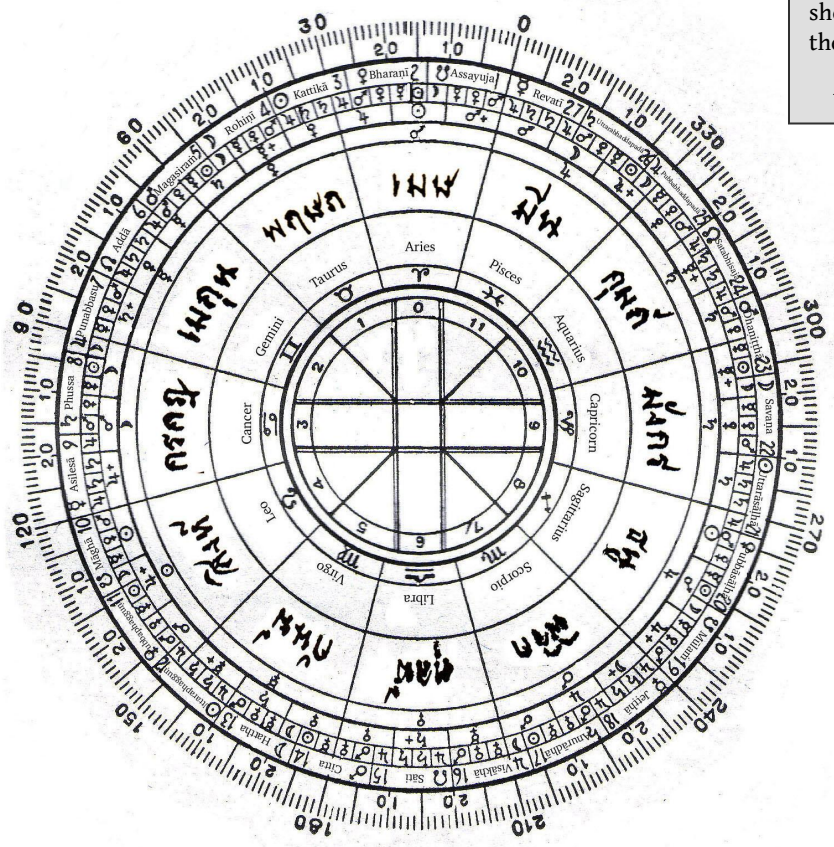
The Lunar and Solar Zodiac

> "A bhikkhu should learn the zodiac in whole or in part, and should be skilled in knowing the directions."
>
> **Araññika-vatta (Cv.VIII.6.3)**



This ancient zodiac diagram is essentially a template map of the cosmos – showing how astronomy and astrology were a 'combined science' in earlier times, giving rise to our calendar. The inner rings show the 12 signs of the solar zodiac (symbol, English, Thai-Sanskrit), while the outermost ring within the circle shows the 27 signs of the lunar zodiac (*sattādhika-vīsa-nakkhattā* in Pāḷi). The zones in the diagram *(nakkhatta-yogā)* correspond very closely to the areas of the actual solar and lunar constellations (imagine the earth orbiting our sun in the centre of the diagram). Since the solar calendar corresponds to the solar zodiac (especially in Thai), and the reckoning of the lunar calendar is directly based on the lunar zodiac, this diagram also functions as a crude calendar – with the sun and the (full-) moon (cycle) nearly opposite each other.

	Lunar Calendar	Solar Calendar	Solar Zodiac Association[/sanskrit]
Hemanta-utu	Magasira-māsa	December/ธันวาคม	Sagittarius/Dhanus
	*Phussa-māsa	January/มกราคม	Capricorn/Makara
	Māgha-māsa	February/กุมภาพันธ์	Aquarius/Kumbha
	*Phagguṇa-māsa	March/มีนาคม	Pisces/Mīna
Gimha-utu	Citta-māsa	April/เมษายน	Aries/Meṣa
	*Visākhā-māsa	May/พฤษภาคม	Taurus/Vṛṣabha
	Jeṭṭha-māsa	June/มิถุนายน	Gemini/Mithuna (Methuna)
	*Āsāḷha-māsa	July/กรกฎาคม	Cancer/Karkaṭa
Vassāna-utu	Savaṇa-māsa	August/สิงหาคม	Leo/Siṁha
	*Bhaddapāda-māsa	September/กันยายน	Virgo/Kanyā
	Assayuja-māsa	October/ตุลาคม	Libra/Tulā (Tulyā)
	*Kattika-māsa	November/พฤศจิกายน	Scorpio/Vṛścika

* months having an *amāvasī cātuddasī*

Calculating the Uposatha – the Lunar Calendar

The lunar calendar is derived from the lunar zodiac. There are three seasons – the cold season *(hemanta-utu*), the hot season (*gimha-utu*) and the rainy season (*vassāna-utu*), each comprised of four months. The names of the months come from the zodiac sign that the moon dwells in on the full-moon night (*puṇṇamī*) of each month.[1] At present we take the waning fortnight (*kāḷa-pakkha*) as the beginning of the month, making the full-moon night the last day of each month.[2]

The moon revolves around the earth in approximately 29½ days, making a lunar month. Each year of 12 months must therefore have 6 months of 30 days and 6 months of 29 days. Present tradition alternates these months, with the even-numbered months having 29 days (magasira-māsa beginning the year). Modern tradition makes the *sukka-pakkha* permanently 15 days, so the *puṇṇamī* is always *paṇṇarasī*. The 29-day (even-numbered) months therefore have a 14 day *kāḷa-pakkha*, so the new moon (*amāvasī*) is *cātuddasī*. Another way of putting it is that the 3rd and 7th uposathas of each season are *cātuddasī*.[3] In summary, the full-moon is always a fifteenth day uposatha, the half-moon is always on the eighth day (*aṭṭhamī*), and the uposatha of the new moon alternates between 15 and 14 days.

The main deviation from this pattern of 14 day uposathas occurs when there is a lunar 'leap year' – and an additional month of 30 days is added to the calendar.

Adhika-māsa

A lunar year of twelve 29½-day months amounts to a year of 354 days, roughly 11 days shorter than the solar year of 365.245 days, so an extra month (*adhika-māsa*) of 30 days must be added every two or three years.[4] In the time of the Buddha this was added in any season, whenever the discrepant days added to a month. Modern Thai practice, which was also standardised in India very early, is to always have the *adhika-māsa* at the end of the hot season as the 'second Āsāḷha' – although it has 30 days rather than the 29 days of the 'first Āsāḷha'. *The adhika-māsa* is added 7 times over a 19-year cycle, with the repeating pattern of 332 3332.

e.g.	1	2	**3**	4	5	**6**	7	**8**	9	10	**11**	12	13	**14**	15	16	**17**	18	**19**
year	1997...		1999...			2002...		2004...			2007...			2010...			2013...		2015...
			2018...			2021...		2023... etc.											

Adhika-vāra

Another deviation in the pattern of 14-day uposathas occurs when there is an *adhika-vāra* – an 'extra day' – added to the calendar to help keep it in sync. There are a number of ways of calculating when this should occur – statististical, astronomical – but none of these have any particular predictive value in knowing when it will be added to the standard Thai calendar. It is generally inserted roughly 11 times in a 57-year cycle, but the only two things that are reasonably certain in the Thai calendar is that it never has an *adhika-vāra* in the same year as an *adhika-māsa*, and when the *adhika-vāra* does occur, it is inserted into Āsāḷha-māsa, making the 7th uposatha of the hot season a 15-day uposatha instead of the expected 14-day, and making Āsāḷha-māsa a 30-day month that year. [5]

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[1] Luang Por Liem – reflecting that things have been deviating from their natural order in recent times – says that the moon's orbit has changed since 1980. Cf. A.IV.70

[2] There is evidence from the canon that the waxing fortnight (*sukka-pakkha*) was considered the beginning of the month in the Buddha's time.(Cf. NP 24, the account of Ven Mahā Moggallāna's parinibbāna, Pāc 57, and the account of the Buddha's cremation) This could have been a result of later interpretation by canonical redactors, since this reckoning was used in Tamil India (and possibly Sri Lanka), while northern India, including the middle country, always had the full moon at the end of the month.

[3] This standardisation of months and fortnights was not introduced until later: they were either more flexible during the Buddha's time or followed exact astronomical reckoning. Cf. The discussion of pavāraṇā in the Mahā-vagga.

[4] The cycle of the full-moon through the nakkhattā loses approx. 10.696 degrees every year after each adhika-māsa because the Earth's orbit is eleven days slower than the 12 orbits of the moon every year – one year after the adhika-māsa, each full-moon will be roughly one nakkhatta behind where it should nominally be; two years, nearly two nakkhattā...

[5] King Mongkut apparently devised a method to abandon this practise, but whether that has been adopted by the Dhammayut calendar remains a mystery...

MISCELLANEOUS

The moon cycles through the whole zodiac on its 'ecliptic' (i.e. a 'sidereal' month) every 27 days, 7 hours and 45 minutes, roughly passing through each successive *nakkhatta* on each successive day (1.012 days). Since the actual lunar cycle ('synodic' month – waning and waxing of the moon) takes roughly 29 days and 12 hours, the next full moon will be two or three *nakkhattā* ahead of the previous one.[6] The cycle of the full moons going through the complete zodiac takes a lunar year.

In order to reconcile the 12 signs of the solar zodiac with the 27 signs of the lunar zodiac, the full sweep of the heavens must be divided into 108 (108÷12=9, 108÷27=4). 108 is therefore a 'special number' that synchronises the cosmos – the standard of 108 mālā beads may represent a symbolic effort to pervade the cosmos with one's mantra... The second-most outer ring in the above diagram shows the heavens divided into 108, with the nine planetary symbols of astrology (นพเคราะห์)[7] which have merely an astrological significance – being associated and dominant signs for each *nakkhatta*.

The solar calendar has mostly usurped the lunar calendar in modern times, but many vestiges of the older reckoning remain.[8] The very reason for dividing the solar cycle into 12 must be derived from the lunar cycle. Months (named after the moon) are still generally about the length of one lunar cycle, although this time-frame has no natural significance for the solar calendar. The lengths of the months vary somewhat in order to amount to 365 days and to allow the solstices and equinoxes to always occur on the 21st. Also, a period of 7 days has no significance for the solar calendar – weeks representing a quarter-phase of the moon – and the days are named after the first seven of the nine heavenly bodies of astrology[9] (in Thai, French, Pāḷi, and Sanskrit – but in English a few norse gods have plundered four days of the week).

Days of the Week

English	French	Pāḷi	Sanskrit	Thai	Planet	assoc. colour
Sunday	Dimanche	ravi-vāra	āditya-vāra	วันอาทิตย์	Sun	red (yellow)
Monday	Lundi	canda-vāra (bhumma-vāra)	candra-vāra	วันจันทร์	Moon	yellow (white)
Tuesday	Mardi	maṅgala-vàāra	maṅgala-vāra	วันอังคาร	Mars	pink (red)
Wednesday	Mercredi	budha-vāra	budha-vāra	วันพุธ	Mercury	green
Thursday	Jeudi	garu-vāra (vihappali-vāra)	bṛhaspati-vāra	วันพฤหส(บดี)	Jupiter	orange/brown
Friday	Vendredi	sukra-vāra (sukka-vāra)	śukra-vāra	วันศุกร์	Venus	blue
Saturday	Samdi	sora-vàāra	śani-vāra (saora-vāra?)	วันเสาร์	Saturn	violet/black

THE CONSTELLATIONS (*sattādhika-vīsa-nakkhattā)*

Assayuja: α arietis (Sheratan), γ arietis (Mesarthim)

Bharaṇī: **35, 39** and **41** arietis

Kattika: pleiades (η tauri (Alcyone), **M45** tauri)

Rohiṇī: α tauri (Aldebaran)

Magasira: λ orionis, φ^1 and φ^2 orionis

Adda: α orionis (Betelgeuse)

Punabbasu: α geminorum (Castor), β geminorum (Pollux)

Phussa: γ cancri (Asellus Borealis), δ cancri (Asellus Australis), θ cancri

Asilesā: δ,ε,η,ρ and σ hydrae

Māghā: α leonis (Regulus), γ leonis (Algieba). ε,ζ,η and μ leonis

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[6] This is because the Earth itself has processed 28.5 degrees of its orbit over that time.

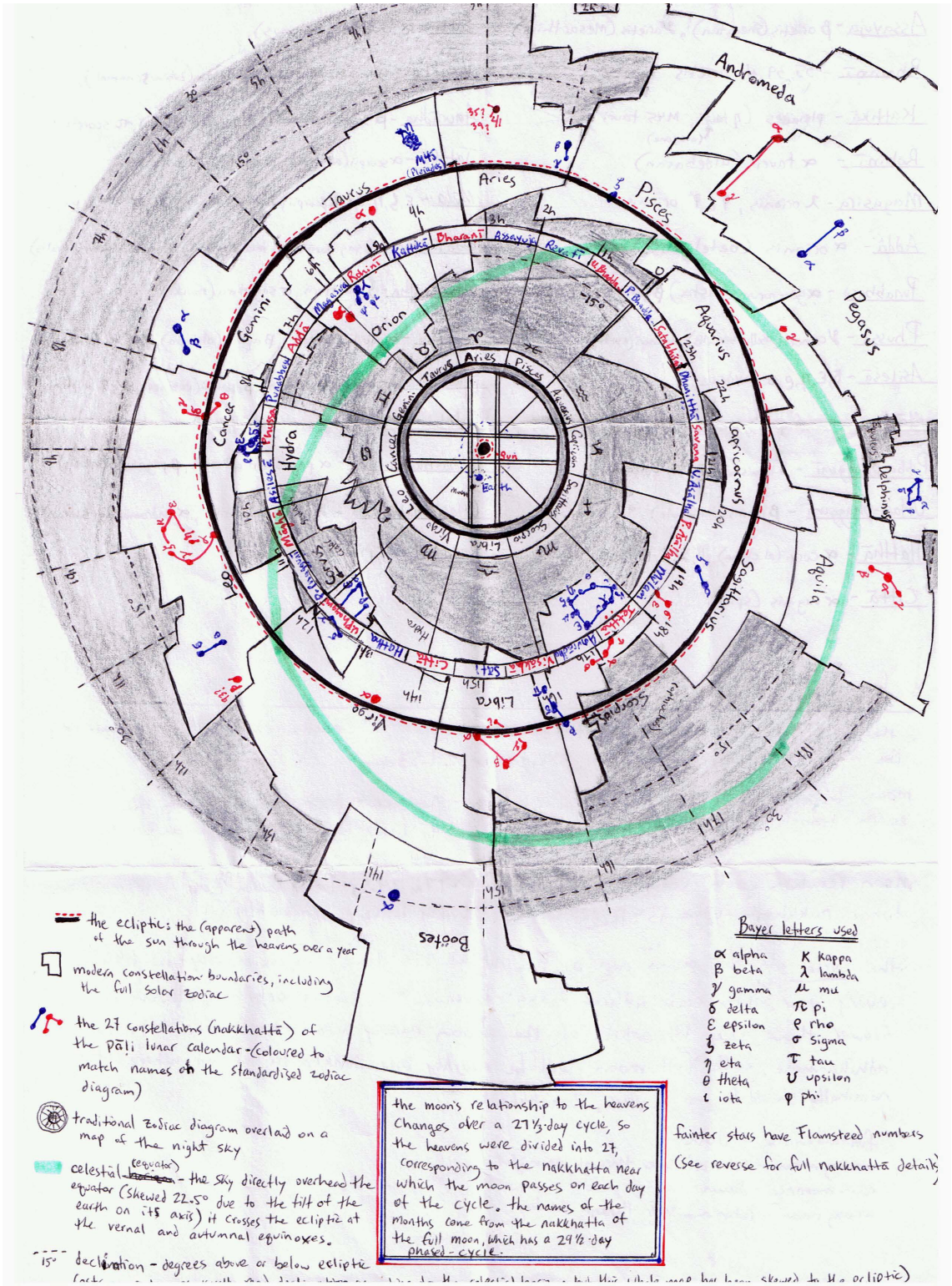
[7] The Pāḷi terms for the ascending and descending nodes (where the moon crosses the ecliptic) are Rahu (the lord of the Asuras) and Ketu, respectively.

[8] Western astronomy with its solar zodiac was imported into India by at least 320 C.E. The Sanskrit versions of the solar zodiac were translated from the Greek.

[9] After Greco-Roman practice.

Pubba-phagguṇī: δ leonis (Zosma), θ leonis
Uttara-phagguṇī: β leonis (Denebola), **93** leonis
Hattha: α corvi (Al Chiba), **β,γ,δ** and ε corvi
Cittā: α virginis (Spica)
Sāti: α boötis (Arcturus)
Visākhā: α librae (Zubenelgenubi), β librae (Zubeneschamali), γ librae (Zubenelakrab), ι librae
Anurādha: β scorpii (Graffias), δ scorpii (Dschubba), π scorpii
Jeṭṭhā: α scorpii (Antares), σ scorpii, τ scorpii
Mūlaṁ: **ε,ζ,η,θ,ι,κ** scorpii, λ scorpii (Shaula), μ and υ scorpii
Pubb'āsāḷha: δ sagittarii (Kaus Meridionalis), ε sagittarii (Kaus Australis)
Uttar'āsāḷha: ζ sagittarii, σ sagittarii (Nunki)
Savaṇa: α aquilae (Altair), β aquilae (Alshain), γ aquilae (Tarazed)
Dhaṇiṭṭhā: α delphini (Sualocin), β delphini (Rotanev), γ and δ delphini
Satabhisaja: γ acquarii (Sadachbia)
Pubba-bhaddapadā: α pegasi (Markab), β pegasi (Scheat)
Uttara-bhaddapadā: γ pegasi (Algenib), α andromedae (Sirrah)
Revatī: ζ piscium

(**Figure next page**: a map of the night sky, including modern solar zodiac boundaries and lunar constellations, overlaid and skewed to the ancient zodiac diagram.)



the ecliptic: the (apparent) path of the sun through the heavens over a year

modern constellation boundaries, including the full solar zodiac

the 27 constellations (nakkhattā) of the pāḷi lunar calendar - (coloured to match names on the standardised zodiac diagram)

traditional zodiac diagram overlaid on a map of the night sky

celestial equator - the sky directly overhead the equator (skewed 22.5° due to the tilt of the earth on its axis) it crosses the ecliptic at the vernal and autumnal equinoxes.

15° declination - degrees above or below ecliptic

the moon's relationship to the heavens changes over a 27½-day cycle, so the heavens were divided into 27, corresponding to the nakkhatta near which the moon passes on each day of the cycle. the names of the months come from the nakkhatta of the full moon, which has a 29½-day phased-cycle.

Bayer letters used

α	alpha	κ	kappa
β	beta	λ	lambda
γ	gamma	μ	mu
δ	delta	π	pi
ε	epsilon	ρ	rho
ζ	zeta	σ	sigma
η	eta	τ	tau
θ	theta	υ	upsilon
ι	iota	φ	phi

fainter stars have Flamsteed numbers

(see reverse for full nakkhatta details)