CHAPTER 6

UDAYĀSTĀDHIKĀRAḤ

(Rising and Setting of Planets)

***Ślokas* 1 and 2: The desired (given) *ahargaṇa* is added with 1/10th of the *gatābda* (elapsed years from the epoch i.e. from *śaka* 1005) and reduced by 105. (The result is) divided by 300. (If) the remainder (is) 15 (then) Jupiter (Guru) has risen. (The remainder) greater than 384 (indicates that) Jupiter is set.**

The rising measure (*udayamāna*) of the *rāśi*, in which the true Ravi lies, is multiplied by 12 and divided by 60 to get in days (etc.) The balance, as in *tithi*, is added or subtracted. The *udayamāna* (of the true Ravi's [15° / 30°, overprinted in margin] *rāśi*) is reduced by 300; the remainder multiplied by 15 and divided by the *udayamāna* (giving) days (etc.) is added to the rising time of Guru (to get the corrected rising time).

(i) Obtain the elapsed years (*gatābda*) from the epochal year (*Śaka* 1105). Find the *ahargaṇa* (from the epoch of this text) for the *iṣṭadina* (given day). Add 1/10 th of the *gatābda* and substract 105 from the result. Divide the difference by 399. When the remainder (r) is 15, it gives the rising of Guru. If the remainder is greater than 384, it means Guru has set.

(ii) Depending on the position of the *sāyana* Ravi in the earlier (less than 15°) or the latter part (between and) the *ghaṭīphalas* are prescribed for the two halves of the different *rāśis* as shown in Table 6.1.

The *ghaṭīphalams* are positive for the six *rāśis* from *Makara* (i.e in IV and I quadrants) and negative for the six *rāśis* from *Karkaṭaka* (i.e. in II and III quadrants).

Table 6.1 *Ghaṭīphalam* of *sāyana* Sun's *rāśis*.

Rāśi	First half <u>gh</u>	Second half <u>gh</u>
Karkaṭaka	3	6
Makara	3	6
Siṃha	8	10
Kumbha	8	10
Kanyā	11	11
Mīna	11	11
Tulā	11	10
Meṣa	11	10
Vṛścika	8	6
Vṛṣabha	8	6
Dhanus	3	0
Mithuna	3	0

The *ghaṭīphalam* of the first or the second half of the *rāśi* occupied by the *sāyana* Ravi at the *iṣṭakāla* is multiplied by 12 and divided by 60. The resultant will be in days etc. Now this is added to or substracted from the remainder *r* obtained in step (i) above according as the *ghaṭīphalam* is positive or negative.

(iii) Add 2 *rāśis* for *udaya* and 3 *rāśis* for the *asta* to (*sāyana*) Ravi. Multiply the *ghaṭīphalam* of the resulting *rāśi* and divide by 60. This is substracted from or added to the result of (ii), according to the sign of the *ghaṭīphalam*. The result will be in days etc. This is substracted from 15 for the *udaya* and from 384 for the *asta*. This gives the days etc. from the *iṣṭadina* for the rising or setting of Guru.

In the case of *asta* (setting), in step (iv), the *udayamāna* of the *rāśi* to be considered is that of *sāyana* Ravi + .

(iv) Take the difference , *rāśimāna* of the *sāyana* Ravi's *rāśi* minus 300. This difference is multiplied by 15 and divided by the *rāśimāna*. The result is in days etc., which should by added to or substracted from (as the case may be) the result of step (iii).

Example : ***Śā.śa*** year 1543 *Aṣāḍha kṛṣṇa* 4, Tuesday, corresponding to June 8, 1621 (G).

(i) *Ahargaṇa* (from the epoch of this text) is 160074. *Sāyana* Ravi = .

The elapsed years from the epoch (*gatābdas*) = 1543 – 1105 = 438 years.

Consider $\left[\qquad + \frac{}{} - \qquad \right] / 399.$

$6^R 29^\circ$

Ignoring the integer quotient we have the remainder $r = 13|48$ days which is less than 15. Hence the *udaya* is yet to occur (*gamya*).

(ii) Now, the *sāyana* Ravi = $1^R\ 29^\circ$ is in the second half of *Vṛṣabha*. From Table 6.1, the Ravi *ghaṭīphalam* = 6 and it is additive.

Now, $\qquad \times \frac{}{} = \frac{\times}{} =$

This is now added to $=$. We get .

(iii) Since we are considering the *udaya* (rising) of Guru, we have

Sāyana Ravi + $2^R = 1^R\ 29^\circ + 2^R = 3^R\ 29^\circ$

lying in the latter half of *Karkaṭaka* whose *ghaṭīphalam* is 6 and substractive. Multiplying by 30, we get 180 and dividing by 60 we get 3 days. This is substracted from the result of (ii) and we get – = 12 days.

(iv) We have

$$\textit{Rāśimāna} \text{ of } \textit{Vṛṣabha} - 300 = 256 - 300 = -44 \; \textit{vig.}$$

We have

$$(-44) \times 15/256 = -2^{d}\ 34^{gh}\ 41^{vig}$$

Now, $12^{d} - 2^{d}\ 34^{gh}\ 41^{vig} = 9^{d}\ 25^{gh}\ 19^{vig}$.

For the *udaya* of Guru, substracting the above result from 15^{d}, we get

$$= 5^{d}\ 34^{gh}\ 41^{vig}.$$

After so many days from the given date, Guru will be rising.

***Śloka*s 3 and 4**: **The (*ahar*)*gaṇa* reduced by 115 and added with 1/16th of the (*gata*)*abda* is divided by 584. For the remainders 36 and 287 (respectively) Śukra rises and sets in the west. For the remainders 297 and 548 (Śukra) rises and sets (respectively) in the east.**

The *udayamāna* of (the *rāśis* of *sāyana*) Ravi reduced by 300, multiplied by 35, 5, 5 and 36 – respectively for rising and setting in the west and in the east – and divided by the *udayamāna* (of *sāyana* Ravi's *rāśi*).This (value) is added to or subtracted from the remainder (*śeṣa*) for rising or setting. If 300 can not be subtracted (*aśodhya*) from the *udayamāna,* then the addition and subtraction of the value (obtained from the difference between 300 and *udayamāna*) with the remainder is reversed.

The risings and settings of Śukra are explained.

(a) Obtain the elapsed years (*gatābda*) from the epochal year ***Sā.sā*** 1105 and *the ahargaṇa* for the given date: Substract 115 from the *ahargaṇa* and to this add 1/16th of the *gatābda*. Divide the resulting sum by 584. Ignoring the integer quotient, consider the remainder *r*. (i) If the remainder *r* is 36, Śukra rises in the west; (ii) if *r* is 287, the he sets in the west; (iii) if *r* is 297, Śukra rises in the east; and (iv) if *r* is 548, then Śukra sets in the east.

(b) Consider the *sāyana* Ravi and the *udayamāna* of the *rāśi* occupied by him. Take the difference, (*udayamāna* – 300). Divide this difference by the *udayamāna* and multiply respectively by 35, 5, 5 and 36 for rising in the west, setting in the west, rising in the east and setting in the east. This is added to or substracted from *r* respectively for rising or setting [If *udayamāna* < 300, then the numeral value is substracted from or added to *r* respectively for rising or setting].

Example: For the same *iṣṭadina* (given in the earlier example), *ahargaṇa* is 160074. *Gatābda* = 438.

$1^R 29^\circ$

(a) $\left[\quad - \quad + \text{—} \right] /$

gives the remainder, $r = 554 | 22$

(ignoring the integer quotient 273).

Since $r > 548$, Śukra has already set in the east by (iv) above.

(b) *Sāyana* Ravi is i.e., in *Vṛṣabha* 2nd half. The *udayamāna* of *Vṛṣbha* is 255 *vig.*

Now, $\frac{(255 - 300)}{255} \times 36 = -\frac{6}{21}$

(number 36 is the multiplier for Śukra's settting in the east).

Combining this result with *r* obtained in step (a), we get

$$- (- \; | \;) = \; | \; + \; | \; = \; | \; .$$

Since Śukra has already set in the east, substracting the corresponding number 548 [see (a) (iv)] we get

$$560|43 - 548 = 12^{d}43^{gh}.$$

***Śloka* 5 : (When the second) *śīghrakendras* are (respectively) 163^0, 145^0, 125^0, 167^0 and 113^0, the planets starting with Kuja attain retrogression. These (values) subtracted from 360^0 are the points of non-regression (direct motion).**

The *śīghrakendras* for the retrograde motion (*vakragati*) etc., are given. The five planets Kuja, Budha, Guru, Śukra and Śani become retrograde (*vakrī*) and then direct (*mārgī* or *avakrī*) when their second *śīghraphalas* attain the values listed in Table 6.2. These are called stationary points.

Table 6.2 Stationary points of planets

Planets	***Śīghrakendrāṁśas* for**	
	retrograde motion	**direct motion**
Kuja		
Budha		
Guru		
Śukra		
Śani		

Note : (i) The stationary points (for retrograde to direct motion) given in the last column are obtained by subtracting the corresponding entries of the middle column from .

(ii) The stationary point for the *vakragati* of Śukra viz., is almost the same as the corresponding modern value for retrogression.

***Śloka* 6 : Kuja rises in the east for (*śīghrakendra*) 28^0, Guru for 14^0 and Śani for 17^0. (Each of them) sets in the west for (*śīghrakendras*) obtained by reducing its rising degrees (*udayāṁśa*) from 360^0.**

The *śīghrakendras* for the (heliacal) rising and setting of Kuja etc., are given (in Table 6.3).

Table 6.3 *Śīghrakendras* for rising and setting of Kuja etc.

Planet	***Śīghrakendrāmśas* for**	
	rising in the east	**setting in the west**
Kuja		
Guru		
Śani		

Note that the above three planets which have their mean daily motion less than that of the Sun always rise (heliacally) in the east and set in the west.

Śloka 7 : **(For *śīghrakendra*) 50^0 and 24^0 (respectively) Budha and Śukra rise in the west, and for 155^0 and 177^0 respectively (they) set in the west. (For *śīghrakedra*) 205^0 and 183^0 respectively Budha and Śukra rise in the east, and for 310^0 and 336^0 (respectively) they set in the east.**

The *śīghrakendras* for the (heliacal) risings and settings in the east and west for Budha and Śukra are given (in Table 6.4).

Table 6.4 *Śīghrakendras* for risings and settings of Budha and Śukra

Planet	***Śīghrakendrāmśas* for**			
	rising in the west	**setting in the west**	**rising in the east**	**setting in the east**
Budha				
Śukra				

Note : The corresponding entries in the 2nd and 5th as also in the 3rd and 4th columns add up to .

Example : Mean Ravi = $11^R\,7^\circ\,56'\,14''$, *Manda* corrected Guru $= 10^R\,23^\circ\,56'\,14''$. *Śīghrakendra* = $^\circ$. *Bhuja jyā* $= 29'$, *koṭijyā* $= 116'$, *Śīghrakarṇa* $= 42|21$, *Śīghraphalam* $= 2^\circ\,13'\,52''$, *Śīghra* corrected Guru = .

$\therefore$ 2nd *śīghrakendra* = Mean Ravi – Cor.Guru = $= 11^\circ\,46'\,8''$. This is less than , prescribed for Guru to rise in the east. Since Ravi is greater than cor. Guru, the rising of Guru in the east will take place when their difference is (i.e.after about 2 days).

Śloka 8 : **The (current) *śīghrakendra* (of a planet) in degrees reduced by the prescribed degrees for direct, retrograde (motion), setting and rising, reduced to *kalās*, divided by the daily rate of motion (in *kalās*) of the *śīghrakendra* gives the days of the completed or the balance (period) for direct motion etc.**

Determining the days etc. for retrograde motion etc. is explained.
For determining the days etc. of retrograde motion, consider the difference between the *śīghrakendra* for *vakragati* and the current *śīghrakendra* of the planet. Divide this by the rate of daily motion of the *śīghrakendra* (i.e. the difference between the daily motions of the Sun and the planet). The result gives the days etc. of the commencement of the *vakragati* (retrogression).
Similar procedure is followed for finding the days etc. for direct motion (*mārga* or *avakra gati*), rising (*udaya*) and setting (*asta*) of a planet.

Example (1) : Kuja's *śīghrakendra SK* = $= 202^\circ\,33'\,47''$.

(True) *śīghrakendra gati* = . The prescribed *śīghrakendra* for the direct motion of Kuja is 197°. The difference between Kuja's *SK* and

. Now Kuja has passed the commencement of direct motion by $5^\circ\ 33'\ 47'' = 333'\ 47''$. Dividing this by the daily rate of motion of the *śīghrakendra* (i.e.), we get

.

This means that Kuja has been in direct motion for $10^{d}\ 43^{gh}\ 36^{vig}$ since its commencement (after changing from the retrograde motion).

Example (2) : We have Budha's *śīghrakendra*, $SK = 2^{R}\ 3^\circ\ 8'\ 43'' = 63^\circ\ 8'\ 43''$. The prescribed *śīghrakendra* of Budha for rising in the west is 50°.

The difference between Budha's *SK* and $= SK - 50^\circ = 63^\circ\ 8'\ 43'' - 50^\circ$

$\frac{\ }{180'\ 24''} = 4^{d}\ 22^{gh}\ 19^{vig}$ $202^\circ\ 33'\ 47'' - 197^\circ = 5^\circ\ 33'\ 47''$ $= 13^\circ\ 8'\ 43'' =$.

Dividing this by the daily motion of Budha's *śīghrakendra* (i.e.,)

we get .

This means that Budha has risen in the west earlier to the given day and time.

***Śloka* 9 : The *kālāmśas* of the moon etc. for direct motion are 12, 17, 13, 11, 09 and 15 and (these) reduced by 1 are (the *kālāmśas*) for the retrograde motion of Kuja etc. The *pātas* (nodes) of Kuja etc are in *rāśis* 11, 11, 9, 10, 8 (followed by) degrees 8, 9, 8, 0 and 17. These (*pātas*) are corrected with the respective *śīghraphalas* with signs reversed.**

The *kālāmśas* and *pātas* of the bodies are given in the following table (Table 6.5).

Table 6.5 *Kālāmśas* and *Pātas* of bodies

Body	*Kālāmśas* for		*Pātas*
	direct motion	retrograde motion	
Candra	12	–	–
Kuja	17	16	$11^R\ 8^\circ = 338^\circ$
Budha	13	12	$11^R\ 9^\circ = 339^\circ$
Guru	11	10	$9^R\ 8^\circ = 278^\circ$
Śukra	09	08	$10^R\ 0^\circ = 300^\circ$
Śani	15	14	$8^R\ 17^\circ = 257^\circ$

The above *pātas* of the planets (Table 6.5) are combined with the *śīghraphalas* of the respective planets to get their corrected *pāta* (*spaṣṭapāta*). (i) If the *śīghraphala* is positive consider *pāta* minus *śīghraphala* and (ii) if the *śīghraphala* is negative then take *pāta* plus *śīghraphala* to get the *spaṣṭa* (corrected) *pāta*. The *pāta* of Budha and Śukra are corrected with the *mandaphalas* of the respective planets.

Note : The *kālāmśa* of a planet is the angle (in degrees) from the Sun within which the planet heliacally rises or sets.

***Śloka* 10** : **The (mean) latitudes (*kṣepakas*) of Kuja etc. are (respectively) 110, 152, 76, 136 and 130 minutes of arc (*liptikās*). The Rsine (*dorjyā*) of the true planet (*śīghrocca* in the case of Budha and Śukra) added with its (*manda* corrected) node (*pāta*) is multiplied by its (mean) latitude (*kṣepa*) and divided by the *śīghrakarṇa* (to get the true latitude in *kalās*). (This result) divide by 3 is the latitude (of the body) in *aṅgulas* etc.**

Obtaining the *śaras* (latitudes) of the five star-planets, Kuja etc is explained.

(1) The mean *vikṣepas* (or *śaras*) of Kuja, Budha, Guru, Śukra and Śani are respectively 110, 152, 76, 136 and 130 (in *kalās*)

(2) (i) In the case of Kuja, Guru and Śani consider the true planet and add its corrected *pāta* to it. In the case of Budha and Śukra add *pāta* to their respective *śīghroccas.*

(ii) Consider the *bhuja jyā* of the *sapātagraha* [i.e., planet + *pāta*, obtained in step 2(i)]. Multiply this *bhuja jyā* by its mean *śara* and divide by its *śīghrakarṇa.* The result gives the *śara* of the concerned planet in *kalās*. Dividing this *śara* in *kalās* by 3, we get the same in *aṅgulas.*

The *śara* is north or south according as the (planet + *pātas*) is less or greater than 180°.

Example : On a certain day, we have

True Budha , daily rate of motion of Budha *śīghrocca* $= 103' 28''$.

$03^R\ 4^\circ\ 57''\ 16'' + 11^R\ 9^\circ\ 15'\ 7''$

Mandaphalam $= +\,0^\circ\ 15'\ 7''$, *śīghrocca* of Budha

Śīghrakendra $= 2^R\ 3^\circ\ 28'\ 43''$, daily motion of *śīghrakendra* $= 180'\ 24''$

Śīghrakarṇa = $145|15$ *aṇgulas, Pāta* of Budha $= 11^R\ 9^\circ\ 0'\ 0''$

Since the *mandaphala* is to combined to the *pāta* we have

Manda corrected *spaṣṭa pāta* $= 11^R\ 9^\circ\ 15'\ 7''$.

Now, the corrected *pāta* has to be combined to the *sīghrocca* of Budha.

$\therefore$ *Sapātagraha* = *Śīghrocca* of Budha + Budha's corrected *pātā*

= = $02^R\ 14^\circ\ 12'\ 23''$

Bhujajyā of *sapātagraha* = $115'\ 6''$

Now,

Śara of Budha =

$$= \frac{115|6 \times 152}{145|15} = 120' \, 27''$$

Dividing by 3, we get

Śara = = 40|9 *aṅgulas.*

***Śloka* 11, 12 and 13 : (In the case of rising and setting) in the east and in the west subtract and add three *rāśis* (90^0) from and to the planet (respectively) and (find) declination (*krānti*) of this. Combine the *krānti* with the latitude to get *nata*. (This *nata*) subtracted from 90^0 is *unnata* in degrees. Obtain the *jyās* (R sines) of *nata* and *unnata* separately.**

Multiply the *jyā* of *natāmśa* by *śara* and multiply (this product) by 3. Dividing (this) by the *jyā* of *unnatāmśa*; (result) obtained (is in) *kalās*. The obtained *kalās* are added to or subtracted from (the longitude of) the planet according as the latitude (*śara*) and the *natāmśa* have the same or the opposite directions.

For (rising or setting in) the west (the positive and subtractive) signs are reversed. Between the planet (with *dṛkkarma* applied) and (the true) sun, the lesser one is *imagined* as the sun and the other as ascendant (*lagna*). The difference in *gha-īs* (*antaragha-ikās* of the *udayamānas* of *rāśis* lying between the two bodies) for (rising and setting in the east), and adding 6 *rāśis* for the west, multiplied by 6 is the desired time in degrees (*iṣ-akālāmśa*). If this (*iṣ-akāla*) is greater than the prescribed *kālāmśa*, then the planet's rising is (already) over and if it is lesser, then the rising of the planet is yet to take place. The reverse is the case for setting.

The difference between the *iṣ-akāla* and the (prescribed) *kālāmśa* (both in *kalās*) is multiplied by 300 and divided by the *udayamāna* (in *vigha-is*) of the *rāśi* of (the *sāyana* planet imagined as) the sun. In the case of (rising or setting in) the west, the division is by the *udayamāna* of the seventh (*rāśi* i.e. the imagined *sāyana* Ravi + 6 *rāśis*).

These *kṣetra kalās* divided by the difference in speeds (of the planet and the sun), in *kalās,* and by the sum for retrograde planet gives the days lapsed or to go for the rising or setting (of the planet).

Obtaining *dṛkkarma* correction and *udaya* (rising) and *asta* (setting) for the planets is explained.

(a) To find *dṛkkarma* :

(i) On a given day, consider the true position of the planet. Depending on the *śīghrakendra* of the planet, if it is the case of rising and setting in the east, subtract 3 *rāśis* from the planet and if it is the case of rising and setting in the west, add 3 *rāśis* to it.

(ii) Consider the declination (*krānti*) δ of the above (i.e., planet 3 *rāśis*). Find *natāṃśa* given by ( ) where is the latitude (*akṣāṃśa*) of the

$\delta \sim \phi$ 90 × ×

place. Compute, *unnatāṃśa* = – *natāṃśa.*

(iii) Find the *jyā* of the *natāṃśa* and *unnatāṃśa.*

Now,

Dṛkkarma = · ·

This is combined with the true position of the planet whose rising and setting timings are required.
The sign (additive or substractive) of the *dṛkkarma* is decided as follows:

(i) In the case of rising and setting in the east, if the *natāmśa* and *śara* have the same direction, then the *dṛkkarma* is additive and if these are in opposite directions then it is subtractive.
(ii) In the case of rising or setting in the west, the signs opposite to the above are considered.

(b) Rising and setting of planets :

(i) Consider the true Sun and the *dṛkkarma* corrected planet. The lesser one between the two is treated as Ravi and the other one as *lagna*. Find the *antaraghaṭikās* (i.e. the difference in time unit by considering the *udayamāna*) of the Sun and the Lagna for rising and setting in the east.

For rising and setting in the west, add 6 *rāśis* (180°) to the above body which is considered as the Sun and then find the *antaraghaṭikās.*

(ii) The *antaraghaṭikās* (in *ghaṭīs*) when multiplied by 6 we get the *iṣṭakālāmśa* (in degrees). If this is greater than the prescribed *kālāmśa* (Table 6.5), then the planet has already risen. If it is less than the prescribed *kālāmśa,* then the planet is yet to rise.

(iii) The difference between the *iṣṭakālāmśa* and the prescribed *kālāmśa* is multiplied by 300 and divided by the *udayamāna* (in *vighaṭīs*) of the *rāśi* of the *sāyana* position of the body considered as the Sun. In the case of rising or setting in the west, consider the *udayamāna* of the seventh *rāśi* (of the considered *sāyana* Ravi) i.e, of *sāyana* position + 6^R.

This result is divided by the difference between the daily motions of the planet and the actual Sun. This gives time interval for the rising and setting in days etc.

In the case of a planet which is retrograde, the sum instead of difference of their daily motions is considered as the divisor.

Example : We shall consider the case of rising of Budha in the west. We have (*Nirayaṇa)* Budha + 3 *rāśis* = .

Adding *ayanāmśa* $18^\circ\ 14'$, we get

Sāyana Budha + $= 5^R\ 5^\circ\ 41'\ 06''$.

Krānti (declination) for $5^R\ 5^\circ\ 41'\ 06'' = 9^\circ\ 32'\ 56''$ North

(as given by Sumatiharṣa).

Akṣāṃśa = N , latitude of the place.

Natāṃśa, = South

Unnatāṃśa = =

We have, *Jyā* (*natāṃśa*) = and *Jyā* (*unnatāṃśa*) =

(Cor.) *Śara* = *aṅg.* for Budha.

∴ *Dṛkkarma* = = 32|24 *kalās.*

Since the *natāṃśa* and *śara* are in opposite directions and we are considering the rising of the planet in the west, the *dṛkkarma* is additive.

Therefore, adding the *dṛkkarma* to the true *nirayaṇa* Budha we get

$$1^R\ 17^\circ\ 27'\ 06'' + 32'\ 24'' \ = \ 1^R\ 17^\circ\ 59'\ 30''.$$

Thus, the *dṛkkarma* corrected (*nirayaṇa*) true Budha = $1^R\ 17^\circ\ 59'\ 30''$.

The true Sun = $1^R\ 3^\circ\ 6'\ 12''$. Since between the two the Sun is less than Budha, we treat Sun's position as itself and Budha's position as of the *lagna*. Since we are considering the rising of Budha in the *west*, the *bhogyakāla* of the (*sāyana* Sun + 6^R) is 98 *vig*. The *bhuktakāla* of the thus considered *sāyana lagna* (i.e. Budha) is 71 *vig.* The sum of these two is 169 *vig.* i.e. $2^{gh}\ 49^{vig}$. Multiplying this by 6, we get ° ′. This is *iṣṭakālāmśa*. Since the *iṣṭakālāṃśa* is greater than the prescribed *kālāmśa* for Budha viz. , the rising of the planet in the west has already taken place; we shall find by how many days etc. earlier this took place. The difference between the *iṣṭakālāmśas* and the prescribed *kālāmśas* is = 3° 54′ = . Multiplying this by 300, we get 70200. The seventh *rāśi* from the Sun (i.e. Sun) is in *Vṛṣcika* whose *udayamāna* is 343 *vig.* The difference in the daily motions of Ravi and

Budha is $= 46|10$. Now, we have $\dfrac{70200}{343 \times 46|10} =$

$4^{d}\ 25^{gh}\ 58^{vig}$.

These days etc. prior to the given day give *Vaiśakha kṛṣṇa aṣṭamī.*

***Śloka* 14 : If the east visible planet is greater or the west visible planet is less than the Sun, (then) the days obtained from the sum of the *iṣ-a* and the (prescribed) *kālāmśas* are (respectively) of the elapsed (*gata*) and the yet-to-occur (*eṣya*).**

If in the case of rising in the east, the planet's position is greater than that of the Sun, and in the case of rising in the west if the planet is less than the Sun, the *gata* (elaspsed) and the *gamya* (to be covered) days etc. get reversed i.e., these become respectively *gamya* and *gata*.

***Śloka* 15 : The shadow of the gnomon (*akṣabhā* or *palabhā* in *aṅgulas*) multiplied by eight is added to and subtracted from 98^{0} and 78^{0} respectively for the appearance (rising) and disappearance (setting) of Canopus (*Agastya,* born out of the pot) when the sun is equal to those (positions in longitude).**

Now, the rising and setting of the *Agastya* (*Canopus*) star is explained.

Multiply the *akṣabhā* (*palabhā*) of the place in *aṅgulas* by 8 and add 98°. When the Sun comes to this position, the *Agastya* star rises.

Similarly, multiply the *akṣabhā* by 8 and substract this from . When the Sun reaches this position, *Agastya* sets.

Example : The *palabhā* of the given place is *aṅgulas*. Multiplying

by 8, we get $^{\circ}\ '$ and adding , we get $= \ ^{\circ}\ ' =$

. When the Sun comes to this position *Agastya* rises. Substracting

44° from , we get = so that when the Sun reaches that point, *Agastya* sets.

To find the days etc. elapsed or to be covered for the rising or setting of *Agastya,* the following procedure is adopted :

Find the differences between the position of the Sun at the sunrise on the given day and the positions obtained above for the rising and setting of *Agastya*. Convert them into *kalās* and divide by the daily motion of the Sun in *kalās*. The results give days etc. elapsed since or to be covered for the rising or setting of *Agastya*.

The rising and setting of the Moon

The method of finding the rising and setting of the Moon is demonstrated in the following example.

$10^{R}\ 402^\circ\ 36'\ 57''$

Example (1) : *Śaka* 1517 *Phālguṇa śukla* 10 (*daśamī*) , Thursday. This day corresponds to February 29, 1596 A.D. (G). The *ahargaṇa* (from the epoch) is 1,50,843.

Mean *nirayaṇa* Sun at the sunset = $10^R\ 21^\circ\ 02'\ 11''$

Mean *nirayaṇa* Moon at the sunset = $11^R\ 6^\circ\ 19'\ 43''$

Mandocca of the Moon = $1^R\ 3^\circ\ 42'\ 36''$

Pāta of the Moon = $0^R\ 2^\circ\ 55'\ 38''$

Ayanāṃśa = $17^\circ\ 52'\ 55''$

True *nirayaṇa* Sun =

Sun's true daily motion = $60'\ 08''$

True *nirayaṇa* Moon =

Moon's true daily motion = $735' 04''$

Cara = – (for the Sun)

Cara corrected True *nirayaṇa* Sun =

Cara corrected True *nirayaṇa* Moon = $11^R\ 09^\circ\ 18'\ 59''$

[The *Cara* correction for the Moon = $\dfrac{-35'' \times 735'\ 04''}{60}$ = = $-7'\ 08''$]

Cor. *Pāta* = $0^R\ 2^\circ\ 55'\ 38''$

Śara = 28|52 *aṅg* (South)

Since we are considering the rising in the west, we have

Cara cor. *nirayaṇa* Moon + 3^R = $2^R\ 09^\circ\ 18'\ 59''$.

Declination of (Moon + 3^R), δ = (North)

Akṣāmśa = (North)

Natāmśa, = (South)

Dṛkkarma =

Dṛkkarma corrected Moon = $11^R\ 9^\circ\ 17'\ 52''$

Dṛkkarma corrected *sāyana* Moon + 6^R

= $11^R\ 27^\circ\ 10'\ 47'' + 6^R$ = ... (1)

Cara cor. *sāyana* Ravi + 6^R = $5^R 10^\circ 51' 13''$ ..... (2)

Between (1) and (2) since the lesser value is in (2), it is treated as the Sun and the value in (1) as the *lagna*. Both are in *Kanyā rāśi.*

The difference = $5^R\ 27^\circ\ 10'\ 47'' - 5^R\ 10^\circ\ 51'\ 13''$

= ° ″ in *Kanyā.*

The *udayamāna* of *Kanyā* for the given place is 333 *vig*. Therefore, for

, we get

Iṣṭakāla = =

Multiplying, this by 6 we get

Iṣṭlakālāmśa = 18°.

The prescribed *kālāmśa* (Table 6.5) for the Moon is . Since the *iṣṭakālāmśa* is greater than the prescribed *kālāmśa*, the Moon has already risen in the west.
The difference between the *iṣṭakālāmśa* and the prescribed *kālāmśa*

= = = .

The *udayamāna* of (*sāyana* Ravi) i.e. of *Kanyā* is 333 *vig*.

Moon's daily motion – Sun's daily motion =

$60'\ 08'' = 674'\ 56''$

$\times\ 333$

$333 \times 674|56$

30

We have, = .

This means that Moon has risen in the west $28^{gh}\ 49^{vig}$ prior to the sunset.

Example (2) : We now consider an example for the setting of the Moon in the east.

Śaka 1523, *Jyeṣṭha kṛṣṇa* 30 (*amāvāsyā*), Thursday. *Ahargaṇa* = 152762.
At the sunrise, we have

True *nirayaṇa* Sun = $1^R\ 21^\circ\ 54'\ 59''$

True *nirayaṇa* Moon = $1^R\ 21^\circ\ 29'\ 46''$

Ayanāṃśa = $17^\circ\ 58'\ 10''$

Cara =

Cara corrected *nirayaṇa* Sun = 1^R 21° 53′ 15″

Cara corrected *nirayaṇa* Moon = 1^R 21° 04′ 58″

Pāta = 3^R 13° 33′ 27″

Śara = 51|49 *aṅgulas*.

Since we are considering the setting of the Moon in the *east*, substracting 3^R from the Moon, we get

Vitribha Candra = and its

Declination (*krānti*) = 12° 53′ 10″ (South)

Natāṃśa =

Dṛkkarma =

Dṛkkarma cor. Moon = 1^R 20° 30′ 13″

As obtained earlier,

Iṣṭakālāṃśa = 11° 18′

This is less than the prescribed *kālāṃśa* of the Moon viz. . Since we are considering the setting in the east, it is already over.

The difference between the two =

Cara cor. *sāyana* Ravi = = 2^R 09° 53′ 09″

i.e. in *Mithuna*.

The *udayamāna* of *Mithuna* = 305 *vig*.

Moon's daily motion – Sun's daily motion = 801′ 58″

We have

= .

This means that the Moon has set $3^{gh}\ 05^{vig}$ before the sunrise of the given *amāvāsyā* day i.e., on the night of *Carturthī* with $3^{gh}\ 05^{vig}$ before sunrise.

Daily rising and setting of planets

The planets' daily rising in the east and setting in the west is explained. The *udayalagna* of the planet rising in the east and the *astalagna* of the planet setting in the west are to be determined.

Example : We shall find the timings of the moonrise in the east and the Moon's setting in the west.

Śā.śa. 1517 *Māgha kṛṣṇa* 4 (*Caturthī*) Saturday

Gatābda = 1517 – 1105 = 412, *ahargaṇa* = 1,50,831

corresponding to February 17, 1596 (G). We have

At the sunset

[illegible] $10^R\ 10^\circ\ 53'\ 53''$

Mean Sun = $10^R\ 9^\circ\ 12'\ 36''$

Mean Moon = $5^R\ 28^\circ\ 12'\ 45''$

Mandocca of the Moon = $1^R\ 2^\circ\ 22'\ 15''$

Moon's *pāta* = $0^R\ 1^\circ\ 27'\ 26''$

Ayanāṃśa = $17^\circ\ 52'\ 52''$

Carapala = 57

Cara corrected Sun =

Cara corrected Moon = $5^R\ 26^\circ\ 50'\ 54''$

Sun's true daily motion = $60'\ 28''$

Moon's true daily motion =

Pāta's daily motion =

Śara of the Moon = *aṅg.* North

Now, for finding the moonrise in the east, we have

Vitribha Candra = $2^R\ 26^\circ\ 50'\ 54''$

Krānti (declination) of the above, δ = (North)

Akṣāṃśa (latitude of the place), = (North)

Natāṃśa, = = (South)

Dṛkkarmaphala =

Dṛkkarma corrected Moon = $5^R\ 26^\circ\ 50'\ 41''$

This is the *udaya lagna* of the Moon.

The *Cara* corrected Sun at the sunrise = $10^R\ 10^\circ\ 53'\ 53''$

This is the *udaya lagna* of the Sun.

Adding 6^R to the *udayalagna*, we get

Astalagna (of the Sun) =

Now, Moon's *udayalagna* – (Sun's) *astalagna*

$= 5^R\ 26^\circ\ 50'\ 41'' - 4^R\ 10^\circ\ 53'\ 53' = 45^\circ\ 56'\ 48''$

The *bhogya kālā* of *astalagna* i.e. of *Simha rāśi* =

vig. = *vig.*

The *bhuktakāla* of the Moon's *udayalagna*

i.e. of *Kanyā rāśi* = = 298 *vig.*

Their sum = (218.4 + 298) *vig.* = 516.4 *vig* = *gh*.

This means that the Moon rises in the east $8^{gh}\ 36^{vig}$ after the sunset on the given day.

CHAPTER 7

ŚṚṄGONNATIḤ

(Elevation of Moon's Cusp)

***Ślokas* 1 and 2(1st half) : The difference between (the algebraic sum of) the moon's declination in arc-minutes (*kalās*) corrected with its latitude (*śara* in *kalās*) and the (declination) of six *rāśis* added to the (*sāyana*) sun is multiplied by Rsine of the longitude of moon reduced by (that of) the moon and (multiplied) by the latitude (in degrees) and divided by 120. (This result is added to or subtracted from the first mentioned difference of *krāntis* to get the all-corrected *krānti* of the moon).**

The *bhuja* of (longitude of) the moon reduced by (that of) the sun, in *rāśis* etc. multiplied by 5 (and the same considered as *degrees* etc).The division (by this result) of the earlier obtained all-corrected declination of the moon, (both reduced to *kalās*), is the *valanam* in *aṅgulas.*

(i) Find the *krānti* (declination) and the *śara* (latitude) of the Moon at the sunset.

(ii) Take the algebraic sum of the *krānti* and the *śara* obtained in (i).

This gives the *śara* corrected *krānti*.

(iii) Find the *krānti* of .

(iv) Find the diference between the two *krāntis* obtained in (ii) and (iii).

(v) Find the *bhjua jyā* of (Moon – Sun). Multiply this *bhuja jyā* by the *akṣāmśa* (latitude) of the place and divide by 120.

This is added to or subtracted from (as the case may be) the result of (iv). This value gives the finally corrected *(sarva samskāra samskṛta) krānti* of the Moon. (vi) Finding the *valanam* : Find the *bhuja* of (Moon – Sun); multiply this by 5. This result, in *rāśis* etc. is taken as *amśas* (degrees) etc. Convert all these values into *vikalās* (seconds of arc).

The finally corrected *krānti* (also in *vikalās*) obtained in (v) is divided by the above result in *vikalās* to get the *valanam* is *aṅgulas*. The direction of the *valanam* is the same as that of the finally corrected *krānti*.

Example : *Śā.Śa.* 1517 *Phālguṇa śukla* (*pratipat*), Thursday.

At the sunset, we have

Nirayana true Moon $= 11^R\ 9^\circ\ 18'\ 59''$, *Ayanāṃśa* = ° ′ ″

Sāyana true Moon

Krānti of the Moon $= 67'\ 36''$ (South), *Śara* $= 86'\ 16''$ (South)

Śara cor. *Krānti* = *krānti* + *śara* $= 153'\ 52''$ (South) ...... (1)

Krānti of + = ′ ″ (North) ...... (2)

Algbraic sum of *krāntis* of (1) and (2) is

$456'\ 15'' - 153'\ 52'' = 302'\ 23'' = 5^\circ\ 02'\ 23''$ (North) ...... (3)

(Moon – Ravi)

Bhuja jyā $(16^\circ\ 20'\ 41'') = 33'\ 41''$

Akṣāṃśa (latitude) of the place (North)

.

..... (4)

Subtracting (4) from (3), we get

$$5^\circ\ 02'\ 23'' - 6^\circ\ 54'\ 04'' = -1^\circ\ 51'\ 41'' = \quad \text{(South)}$$

Thus, Moon's finally corrected *krānti* (S) ..... (5)

Bhuja of (Moon – Sun)

Multiplying the *bhuja* by 5, we get

$$\times 5 = 2^R\ 21^\circ\ 43'\ 25'' = \frac{\ ^\circ\ \ '\ \ ''\ \times\ \ '\ \ ''}{'}$$

Treating the above value in *rāśis* etc. as in degrees etc., we have

$$2^\circ\ 21'\ 43'' = 8503''$$

The finally corrected *krānti* [(from (5)]

∴ *Valanam* *aṅgulas*

***Ślokas* 2 (2[nd] half) and 3 (1[st] half)** : **The *ko-i* of the (longitude of) moon reduced by (that of) the sun divided by 15 is the divisor (*hāra*). The quantity obtained by dividing 36 by this (divisor) is kept in two places and (then) reduced by or added with the divisor (*hāra*) and halved are respectively *vibhā* (or *sita*, illuminated) and *svabhā* (or *asita*, un-illuminated).**

Now, the *sita* and *asita* measures (of illumination and darkness) of Moon are explained.

Find the *koṭi* (i.e. the complement of the *bhuja*) of (Moon – Sun). Divide the *koṭi* by 15; the quotient is called the *hāra*. Then we have

$$Vibh\bar{a} = -\left[\frac{{}^{\circ}}{\quad} - \quad\right]$$

$$Svabh\bar{a} = -\left[\frac{{}^{\circ}}{\quad} + \quad\right]$$

Example : We have, in the above example, *Bhuja* of (Moon – Sun) $= 16^{\circ}\ 20'\ 41''$

Koṭi of (Moon – Sun) = – ° ′ ″ = .

Hāra = =

Dividing by the above value we have $\frac{36^{\circ}}{4|53} = 7|20$

Vibhā = *aṅgulas*

$Svabh\bar{a} = \frac{7|20 + 4|54}{2} = \frac{12|14}{2} = 6|07$ *aṅgulas*

***Ślokas* 3 (2nd half) and 4** : **Drawing a circle (representing the moon) with diameter of six *aṅgulas*, the *valanam* is marked on it (based on its**

direction). The (measure in *aṅgulas* of) the *valanam* is marked in eastern direction for the bright fortnight (*śukla pakṣa*) and in the west for the dark fortnight (*kṛṣṇa pakṣa*). From the point (representing) the end of the *valanam* cut off the measure of the illuminated part (*vibhā*) towards the centre (of the circle). With the (point representing) the end of the *vibhā* draw circle with (the measure of) the un-illuminated part (*svabhā*) as diameter. This result is the shape of the fractured moon (in the shape of horns). [The horn-shape is in the direction opposite to the *valanam*].

On the even level ground draw a circle of diameter 6 *aṅgulas*. This is considered as representing the Moon. Mark the east, west, north and south directions. Then the *valanam* measure (obtained earlier) is marked as per its direction. This is done on the eastern side in the case of the *śukla pakṣa* (bright fortnight and on the western side in the *kṛṣṇa pakṣa* (dark fortnight). Starting from the end point of the *valanam*, spreading a thread towards the centre of the circle, cut off the length corresponding to the *vibhā* (illuminated) measure. Taking this point as the centre, draw a circle whose diameter is equal to the *svabhā* (unilluminated) measure. This yields *"fractured"* Moon in the shape of the *"horns"*. The *śṛṅga* (horn) shape is in the direction opposite to that of the *valanam.*

Example 1 : *Śā.Śa.* 1539 *Āśvina (Āśvayuja) śukla* 6 *(Ṣaṣṭhī)*, Friday.

Gatābda = 1539 – 1105 – 434, *Ahargaṇa* 1,58,733

corresponding to Octber 6, 1617 (G).

At the instant of sunset we have

Cara corrected true Sun $= 5^{R}\ 25^{\circ}\ 17'\ 17''$

Cara corrcted true Moon = $8^{R}\ 12^{\circ}\ 03'\ 00''$

Sun's true daily motion $= 59'\ 21''$

Moon's true daily motion $= 774'\ 05''$

Ayanāṃśa $= 18^\circ\ 14'\ 31''$

Krānti (declination) of Moon (South)

Akṣabhā of Yodhapurī $= 5|5$ *aṅgulas*

Śara of the Moon $= 197'\ 57''$ (South)

Śara corrected *krānti* $= 1437'\ 11'' + 197'\ 57'' = 1635'\ 08''$ (South)

Krānti of *sāyana* $+ \quad = \quad ' \quad ''$ (North)

The algebraic sum of the above two *krāntis*

$= - \quad ' \quad '' \quad ' \quad '' = -$

$=$ (South) (South)

.... (1)

Bhuja jyā of (Moon – Sun) =

Latitude, *Akṣāṃśa* (of Yodhapurī) (North)

Bhuja jyā $\cdot$ $= \quad ^\circ \quad ' \quad ''$ (North)

.... (2)

Subtracting (2) from (1), we get

$= -$ (S)

.... (3)

This is the finally corrected *krānti* of the Moon.

Bhuja of (Moon – Sun) $= 2^R\ 17^\circ\ 16'\ 43''$

Multiplying the above result by 5, we get

$2^R\ 17^\circ\ 16'\ 43'' \times 5 = 12^R\ 26^\circ\ 23'\ 35''$

Considering this as degrees, we have $12^\circ\ 26'\ 23'' = 44783''$
.... (4)

Valanam $= 3|47$ *aṅgulas* [from (3) and (4)].

We have

Bhuja of (Moon – Sun) $= 2^R\ 17^\circ\ 16'\ 43''$

$\therefore = \frac{169795}{44783}$

$\therefore$ *Hāra* =

We have

Vibhā

$= 21|38|56$ *aṅgulas.*

We consider the following example for the last quarter of a lunar month.

Example 2 : *Śā.Śa.* 1539 *Kārtika Kṛṣṇa* 13 (*trayodaśī*), Friday.

Ayanāṃśa $= 18^\circ\ 14'\ 34''$ *Ahargaṇa* = 1,58,754 corresponding to October 27, 1617 (G).

At the time of sunrise, we have

True Sun

True Moon $= 5^R\ 18^\circ\ 34'\ 30''$

True daily motion of the Sun $= 61'\ 28''$

True daily motion of the Moon $= 722'\ 20''$

Pāta of the Moon $= 2^R\ 1^\circ\ 12'\ 0''$

True daily motion of the *pāta* $= 3'\ 11''$

Declination (*krānti*) of the Moon $= \quad ' \quad ''$ (South)

Śara of the Moon $= \quad ' \quad ''$ (South)

∴ *Śara* corrected *krānti* = (South)

Krānti of = $' \quad ''$ (North)

The algebraic sum of the above two *Krāntis,*

Cor. *Krānti* $= \quad ' \quad '' = 7^\circ\ 24'\ 57''$ (North)

..... (1)

Bhuja jyā of (Moon – Sun)

Akṣāmśa $= 24^\circ\ 35'\ 09''$

Now, (North) ..... (2)

Subtracting (1) from (2), we get

$$11^\circ\ 48'\ 41'' - 7^\circ\ 24'\ 57'' = 4^\circ\ 23'\ 44'' = \qquad \text{(North)} \qquad \ldots\ldots (3)$$

This is the finally corrected *krānti* of the Moon.

Bhuja of (Moon – Sun)

Koṭi

Bhuja

Considering this as in degrees, we have $4^\circ\ 23'\ 50''$ .... (4)

$\therefore$ *valanam* [from (3) and (4)]

$= 0^\circ\ 59'$ (South)

15830″

Hāra = $= \dfrac{61^\circ\ 13'\ 54''}{15} =$

Now, = =

$\therefore$ *Vibhā* = = $\approx 2|22$ *aṅg.*

Svabhā = = $\approx 6|27$ *aṅg.*

Note : In Examples 1 and 2 above the two days considered are in the same lunar month (with a difference of 21 days in their *ahargaṇa*). The commentator gives the first one as in the *Āśvina* bright half and the second as in the *Kārtika* dark half.

CHAPTER 8

GRAHAYUTI

(Planetary Conjunctions)

***Ślokas* 1 and 2 (I^st half) : (The mean diameters in arc-minutes, *kalās*, of Kuja etc. namely) 5, 6, 7, 9 and 5 kept separately. (The related mean diameter) is multiplied by the difference between the radius (120) and the *śīghra karṇa* (*śīghra* hypotenuse) and divided by 3 times *parākhya* (of the concerned planet). The result is subtracted from or added to the separately kept mean diameter according as the *śīghra karṇa* is greater or less than the radius (120) and divided by 3 (to get) the diameter in *aṅgulas*.**

The mean diameters of the five *tārāgrahas* in *yojanas* and *kalās* are as given in Table 8.1 below.

Table 8.1 Diameters of planets

Planet	Kuja	Budha	Guru	Śukra	Śani
Diameter *kalās*	5	6	7	9	5
Diameter *yojanas*	1885	279	16649	1110	2955

To get the true diameter (*bimba*) of a planet, multiply the mean diameter in *kalās* (given in Table 8.1) by the difference between *trijyā* (120) and the *śīghra karṇa* and divide by 3 times the *parākhya* (given in Chapter 2, *Śloka* 2).

This result is added to or subtracted from the mean diameter (in *kalās*) according as the *śīghra karṇa* is less than or greater than the *trijyā* (120).

That is, if the mean diameter is denoted by *MD*, the *śīghrakarṇa* by *SK*, *parākhya* by *P,* then the true diameter *TD* is given by

$$TD = MD + \frac{(120 - SK)}{3 \times P\square} \times MD \text{ } kal\bar{a}s.$$

Dividing the above value by 3, we get *TD* in *aṅgulas.*

Example 1 : For Guru, *MD* = 7 *kalās,* *kalās, parākhya* = 23.

$$\therefore TD = 7 - \frac{(15|9) \times 7}{3 \times 23} \text{ } kal\bar{a}s = 5|29 \text{ } kal\bar{a}s.$$ Dividing by 3, *TD* = $1|49$ *aṅgulas.*

Example 2 : For *Śukra*, *MD* = 9 *kalās*, $SK = 89|23$, *parākhya* = 87.

$$\therefore TD = 9 + \frac{(120 - 89|23) \times 9}{3 \times 87} = 10|3 \text{ } kal\bar{a}s.$$

Dividing by 3, $TD = 3|21$ *aṅgulas.*

***Ślokas* 2 (2nd half) and 3 : The difference in the (longitudes of the conjuncting) planets in arc minutes (*kalās*) divided by the difference in their daily motions (faster motion minus the slower) if they move in the same direction, or by the sum (of the daily motions) if one of them is retrograde, is the (number of) days elapsed since conjunction. The conjunction is past (*gata*) or yet to occur (*eṣya*) according as the (longitude of) the slower planet is less (than that of the faster one) or the other way.**

Determination of the instant of conjunction (*grahayuti*) of two planets is explained.

(i) Find the difference between the positions of the two planets (in *kalās*).

(ii) Divide the result of (i) by the *difference* between the true daily motions of the two planets (in *kalās*) if the planets are both in direct motion or both retrograde.

On the otherhand, if one planet is direct and the other is retrograde then the result of (i) is divided by the *sum* of the true daily motions of the two planets.

The result of (ii) is in days etc. While taking the difference, the true daily motion of the slow moving planet is subtracted from that of the fast moving one.

If the position of the slow moving planet is less than that of the fast moving planet, then the conjunction is past *(gata)* by days etc. obtained above. On the otherhand, if the position of the fast moving planet is less than that of the slow moving one, then their conjunction is due (*gamya*) by the days etc. obtained earlier.

Example *: Śā. Śa.* 1541 *Vaiśākha kṛṣṇa* 14*,* Sunday. *Ahargaṇa* = 1,59,288 corresponding to April 14, 1619 (G).

Note: Sumatiharsa's date is not correct. The given conjunction falls on May 12, 1619(G), Sunday. The correct KK ahargana is 159316.

True Guru = $\quad^{\circ} \quad' \quad''$ and True Śukra $= 11^{R}\ 16^{\circ}\ 51'\ 26''$ at the sunrise.

Guru's true daily motion $= 11'\ 31''$

Śukra's true daily motion $= 60'\ 57''$.

Since the slow moving Guru's position is less than that of the fast moving Śukra, their conjunction (*yuti*) was recently over (*gata*).

The instant of conjunction

$$= \frac{(11^{R}\ 16^{\circ}\ 51'\ 26'' - 11^{R}\ 16^{\circ}\ 39'\ 07'')}{(60'\ 57'' - 11'\ 31'')} = \frac{12'\ 19''}{49'\ 26''}\ \text{day} = 0^{d}\ 14^{gh}\ 56^{vig}$$

This means that the conjunction of Guru (Jupiter) and Śukra (Venus) took place about $14^{gh}\ 56^{vig}$ ($5^h\ 58^m\ 24^s$) before the *sunrise* of the given day.

***Ślokas* 4, 5 and 6** : **From the motion for the days (etc.) for (or since) the conjunction thus obtained they (the two planets) become equal (in longitudes). The latitudes (of the two bodies) are to be worked out. Here, (in the case of the) moon's latitude (it) has to be corrected with its *nati*. If the (two) latitudes (*śaras*) have the same or different directions, respectively their difference or sum is considered. If the difference in latitudes (as explained above) is less than the sum of the semi-diameters (of the two bodies) then the "*bheda*" conjunction occurs. All operations starting with (the effect of the) parallax are carried out as in solar eclipse. The slower moving body is considered as the sun and the faster one as the moon (if both have direct motion). If one of them is retrograde (*vakrī*) then that (body) is considered as the sun whether it is slower or faster. If both are retrograde, then the faster one is taken as the sun. If the (common longitude of either) planet (in conjunction) in the night is less than the ascendant (*lagna*) and greater than the descendant (i.e. *lagna* + 180^0) the conjunction is visible. [If the longitude of the planets lies between the ascendant and the descendant, the conjunction is not visible].**

Determination of details related to the conjunction of two planets is explained.

In the case of conjunction of two planets its instant and their equal longitudes are first obtained.

Śara : Find the sum of the planet and its *pāta*. Obtain the *bhuja jyā* of this sum. Multiply the *bhuja jyā* by the *vikṣepa (*mean *śara)* and divide by *śīghra karṇa.* Dividing by 3, we get the *śara* in *aṅgulas* (see *Śloka* 10, Chapter 6, *Udayāstādhikāra*).

The *śara* is north or south according as the (planet + *pāta*) is less than or greater than 180°.

(a) If the two planets have their *śaras* in opposite directions, then the two planets are in the respective directions of *śaras.*

(b) If both the planets have their *śaras* north, then the planet with greater *śara* is considered as in the north relative to that of the lesser *śara* considered to be in south.

(c) If both the planets have their *śaras* south, then the one with less *śara* is considered to be in the north relative to the other.

If both planets have the same direction then take the difference of their *śaras.* If in opposite directions, then consider their sum. This gives *spaṣṭa śara.* The result when divided by 24 gives us the value of *hastas.*

If both planets have direct motion, then the one with slower motion is considered as the Sun and the other as the Moon.

If one of the planets is retrograde *(vakrī)* then it is treated as the Sun, irrespective of its motion being faster or slower, and the other planet as the Moon.

If both planets are retrograde, then the faster one is taken as the Sun and the other as the Moon.

The planet thus considered as the Sun is taken as the *chādya* (eclipsed)and the other planet (considered as the Moon) is taken as the *chādaka* (eclipser) as in the case of a solar eclipse.

Treating the *yutikāla* (instant of conjunction) as the *darśānta* (end of the newmoon day), find the *lambana*, *nati*, *sthiti, sparśakāla* and *mokṣa kāla* as in the case of the solar eclipse.

Example : From the examples considered under *Ślokas* 2 and 3, we have obtained, the instant of conjunction $= 0^{d}\ 14^{gh}\ 56^{vig}$ (before the sunrise of the given day). For this instant of conjunction, we have

True Guru $= 11^{R}\ 16^{\circ}\ 36'\ 15''$

True Śukra $= \quad ^\circ \quad ' \quad ''$

Pāta of Guru $= 9^R\ 8^\circ\ 0'\ 0''$

Corrected *pāta* of Guru = *Pāta* $-$ *śīghraphala*

Sapāta Guru = Guru + cor. *pāta*

Bhujajyā of *Sapāta* Guru = $116'\ 23''$

Vikṣepa (i.e., Mean *Śara*) = (South)

Śīghrakarṇa = .

Śara of Guru = (South)

Dividing by 3,

Śara of Guru = *aṅgulas* (South)

Pāta of Śukra $= 10^R\ 0^\circ\ 0'\ 0''$

Mandaphala of Śukra = + $1^\circ\ 31'\ 11''$.

Corrected *pāta* of Śukra = *Pāta* + *mandaphala* =

$\therefore$ *Sapāta* Śukra = *Śīghrocca* of Śukra + cor. *pāta*

Bhuja jyā of *sapāta* Śukra =

Vikṣepa (i.e., mean *śara*) =

Śīghrakarṇa = .

Śara of Śukra

Dividing by 3, we get

Śara of Śukra $= 23|03$ *aṅgulas* (South)

Now, since both Guru and Śukra have their *śaras* in the same direction (south), the lesser *(śara)* of the two is of Guru. Therefore, Guru is considered as in the north relative to Śukra.

Here, both Guru and Śukra have direct motion. The slower moving Guru is treated as the Sun and the faster Śukra as the Moon for determining *lambana, nati* etc as in the solar eclipse.

$= \frac{89623'' \times \quad ''}{\quad ' \quad ''} = \quad ' \quad ''$

At the instant of conjunction , we have

True *sāyana* Guru $= 0^R\ 4^\circ\ 52'\ 25''$ (*Ayanāmśa* =

Sāyana lagna $= 9^R\ 26^\circ\ 21'\ 39''$

(Sāyana) vitribha lagna $= 6^R\ 26^\circ\ 21'\ 39''$.

(sāyana) Guru – *(sāyana) vitribha lagna*

$= \quad ^\circ \quad ' \quad '' - \quad ^\circ \quad ' \quad '' = \quad ^\circ \quad ' \quad ''$

Bhuja of the above difference $= 6^R - 5^R\ 8^\circ\ 30'\ 46'' = 21^\circ\ 29''\ 14''$.

We have *madhya lambanam* $= 2|10$ gh.

Spaṣṭa lambanam = $1|52$ gh.

Now, both *(sāyana)* Guru and Śukra, having the positions $0^R\ 4^\circ\ 52'\ 25''$ *(Meṣa)* are greater than the *sāyana lagna (Makara)* i.e. $9^R\ 26^\circ\ 21'\ 39''$ *(Makara)* and less than the *sāyana asta lagna* (i.e. $3^R\ 26^\circ\ 21'\ 39''$). Therefore, the *yuti* (conjunction) is *not visible* at the given place. However, the *bheda yoga* is there. We have

Manaikyārdha = $-$(dia. of Guru + dia. of Śukra)

= $-$ | | = | *aṅgulas* .... (1)

Since both *śaras* have the same direction (south), taking their difference, we get the corrected *śara*. We have

nati $= 0|31$ *aṅgulas* (South)

Nati corrected *śara* of *Śukra* = $= 23|03 + 0|31 = 23|34$ *aṅg* (South)

Difference between the *śara* of Guru and the *nati* corrected *Śukra*

$= 23|34 - 21|48 = 1|46$ *aṅgulas* .... (2)

Since *mānaikyārdha* > Difference in *śaras* from (1) and (2), there is the *bheda yoga*. But this *yuti* is not visible at the given place.

Example : *Śā. Śa.* 1541 *Phālguṇa śuddha trayodaśī*, Monday.

Gatābda $= 1541 - 1105 = 436$ years, *Ahargaṇa* = .

This corresponds to March 16, 1620 A.D. (G).

Mean Guru = , Mean Ravi =

Śukra *śīghrocca* = ° ′ ″

Cara corrected true Sun $= 11^R\ 08^\circ\ 14'\ 19''$

True motion of the Sun = $59'\ 41''$

True Guru , True *Śukra* $= 0^R\ 1^\circ\ 57'\ 57''$

Guru's true daily motion $= 13'\ 27''$, Śukra's true daily motion $= 73'\ 04''$.

As explained earlier, the conjunction of Guru and Śukra took place $0^d\ 38^{gh}\ 14^{vig}$ earlier i.e. on *Phālguṇa śuddha dvādaśī*, Sunday,

$= 0^R\ 1^\circ 19'\ 13''$ $21^{gh}\ 46^{vig}$ = (–) from sunrise on that day. This is the mean time of conjunction.

At $21^{gh}\ 46^{vig}$ on Sunday, we have

True Sun $= 11^R\ 7^\circ\ 36'\ 18''$, True Guru $= 0^R\ 1^\circ\ 10'\ 58''$

True Śukra $= 0^R\ 1^\circ\ 10'\ 55''$

Śara of Guru $= 20|56$ *aṅgulas*, *Śara* of Śukra $= 11|34$ *aṅgulas*

Diameter of Guru $= 1|38$ *aṅgulas*, Diameter of Śukra $= 2|18$ *aṅgulas*

Sāyana vitribha lagna $= 1^R\ 12^\circ\ 56'\ 41''$

Unnatāṃśa of the above $= 81|26|52$

Jyā of *unnatāṃśa* = $118|17$ *kalās*

Between Guru and Śukra, the one which is treated as the Sun has its *sāyana* position : (Considered) *sāyana* Śun $= 0^{R}\ 19^{\circ}\ 27'\ 48''$ (i.e. true *sāyana* Guru)

Vitribha lagna $-$ (considered) *sāyana* Sun

=

Mean *lambana* (from the *khaṇḍas*) =

Since the *nata* is western and the *vitribha lagna* is greater, the *spaṣṭa yuti* time is given by the sum of the mean *yuti* time and the *lambana.*

i.e. *Spaṣṭa yuti* $= 21^{gh}\ 46^{vig} + 2^{gh}\ 02^{vig} = 23^{gh}\ 48^{vig}$.