A PLANETARY EPHEMERIS IN JAPANESE BUDDHIST ASTROLOGY: A CASE OF TRANSMISSION*

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1. Introduction

The purpose of comparing two or more items is, of course, to know better the items themselves. But without proper knowledge of each item, the comparison would turn out to be superfluous. Thus we sometimes feel uneasy when we undertake a comparison between cultures without sufficient knowledge of each of the cultures to be compared. On the other hand, we sometimes acquire a new perspective when we look into one culture with the eyes with which we have seen another.

This was the case when I was studying the history of Indian astronomy and astrology and eventually turned my eyes onto the Buddhist astrology practiced during the Heian period (平安時代 794-1192). I did not have sufficient knowledge of the history of Japanese astronomy and astrology, but I did discover one very interesting way that the transmission of science occurred within Buddhism. This process might also prove fruitful when comparing the roles played by Christianity or Islam in the transmission of science.

The aim of the present paper is to explain the nature of the planetary ephemerides written in Chinese by an Indian priest but preserved in Japan, and to illustrate an example of the Buddhist astrology practiced in the Heian period.

2. The Text

The Chinese text of the *Qiyao rangzai jue* (hereafter *QR*)[1] is contained in the vol. 21 of the *Taishô Daizôkyô*, where several texts on astrology are collected. The most famous of them are two Chinese translations[2] of the *Śārdūlakarṇāvadāna and the Xiu*

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1. *Taishô Daizôkyô* 大正大蔵経 no. 1308: 七曜攘災決. The text was first studied in Yabuuti Kiyosi 藪内清, *Chûgoku no Tenmon-Rekihô* 中国の天文暦法 [Chinese Astronomical Calendrics] (Tokyo: 1969 [2nd ed. 1990]), pp. 181-185. The present paper is just a humble supplement of Prof. Yabuuti's work.

2. *Taisho Daizôkyô* nos. 1300: *Madeng jiajing* 摩登伽經 and 1301: *Shetoujian taizi ershiba xiu jing* 舍頭諫太子二十八宿經.

K. Hashimoto *et al.* (eds.) *East Asian Science: Tradition and Beyond*, 73 – 81.
1995, Kansai University Press, Osaka.

yao jing[3] composed by Bukong (不空 Amoghavajra [c. 700-774]) in 764.

The *QR* was written by a "Western Indian Brāhman named Jin ju zha (金俱吒)" sometime around A.D. 800. Since it did not gain much popularity in China, it fell into oblivion and had little influence on Chinese astrology. But the text was brought to Japan in 865 in the guise of a Buddhist scripture, and was carefully (probably, secretly) preserved by the circle of Buddhist astrologers until recent times. It was used as a handbook by those astrologers who wanted to find the positions of planets without having to use difficult computations.

The text of the *QR* in the *Taishô Daizôkyô* which is now available was poorly printed, and the ephemerides, which are the main body of the text, do not make sense as tables. This is probably because the compilers of the *Taishô Daizôkyô* were neither familiar with nor interested in astronomy.

I looked for a better text and eventually obtained a photocopy of a manuscript from the late Prof. Momo 桃.[4] In my present discussion I rely extensively on this manuscript.

The colophon of the manuscript says that it was handed down to an astrologer called Chinya (珍也) in the "third year of Hôan (保安)", that is, A.D. 1122. He claims that he was the "119th master of Sukuyôdô (宿曜道) in Japan". The date is very close to that of the oldest Japanese horoscope, which was cast for January 15, 1113.[5]

Unlik the *Daizôkyô* text, the manuscript is well-written, with the ephemerides neatly arranged without distortion. As will be shown below, the manuscript was actually used by some astrologers of the Heian period.

2.1. Contents of the Text

The manuscript consists of 57 folios including the title page and colophon. The contents of the text are summarised as below.

fol. 2	Introduction
fols. 3-6	The methods of exorcising the gods of the seven luminaries, in the order of the Sun, Moon, Jupiter, Mars, Saturn, Venus, and Mercury.
fol. 7	Table of the extension of the 28 lunar mansions (*xiu*).
fol. 7	Table of the lucky and unlucky "places" (Lat. *domus*, Skt. *bhāva*) for each of the seven luminaries.
fol. 8	Table of the 12 places and their meaning.
fol. 9	Diagram of the *xiu* version of the "zodiacal man" (Skt. *kālapuruṣa*)
fols. 10-11	Mantras for the Seven Luminaries.

3. *Taishô Daizôkyô* no. 1299: Wenshu shili pusa ji zhuxian suoshuo jixiongshiri shane xiuyao jing 文殊師利菩薩及諸仙所説吉凶時日善悪宿曜經. Cf. Yano Michio, "The Hsiu-yao Ching and its Sanskrit Sources," *History of Oriental Astronomy*, IAU Colloquium 91, (Cambridge, U.K.: Cambridge University Press, 1987), pp. 125-134.

4. According to Momo H., "Nichien no Futenreki Seirai" (The Fu tian li (符天暦) obtained by Nichien), *Ritsuryô Kokka to Kizoku Shakai* [The Ordinance State and the Aristocratic Society] (Tokyo: 1968), pp. 354-420, the manuscript was privately owned by a Mr. Sakai. Upon my request Prof. Momo kindly duplicated his photocopied version and sent it to me. No further information is available about the background of the manuscript.

5. Cf. Yano Michio, "The *Ch'i-yao jang-tsai-chüeh* and its Ephemerides," *Centaurus* vol. 29 (1986), pp. 28-35, esp. p. 32.

fols. 12-43 The ephemerides for the five planets and Rāhu (Moon's ascending node) and Ketu (Moon's apogee).[6]
fols. 44-46 The images of the Venus, Jupiter, Mercury, Mars and Saturn, in this order.
fols. 46-49 Combination of the *xiu* and planets.
fols. 50-52 Table of the daily position of the sun.
fols. 53-55 The Five planets and the twelve places.

2.2. Preamble of the Ephemeris

Each ephemeris is preceded by a brief preamble, in which the synodic period and the number of days required for each phenomenon are given. I shall translate the preamble of the ephemeris for Jupiter:

> Jupiter is the essence of the Eastern direction. The other name is *Sheti* (攝提). Its diameter is 100 *li*. Its color is blue. It is bright and auspicious. When it is in conjunction with Venus there are deaths. Its progress in 12 years completes one [sideral] rotation plus a little more. In 399 days it completes one synodic period. It first appears in the east in the early morning and progresses [at the rate of] one degree in 6 days, thus gaining 19 degrees in 114 days, and then remains in station for 27 days. It retrogrades [at the rate of] 1 degree in 7 and a half days, thus losing 11 degrees in 82 and a half days. After being in station for 27 days, it progresses again 19 degrees in 114 days, and sets in the west in the evening. After disappearing for 32[7] days it appears again in the early morning as before. In 83 years it completes about 76 [synodic periods] and 7 [sidereal] rotations.
>
> After the last sentence the following commentary was added by a Japanese hand:
>
> The epoch, the tenth year of Chinese Zhenyuan 貞元, [the eleventh year of the 60-year cycle] *jiaxu* 甲戌, correponds to the 13th year of Japanese Enryaku 延暦, *jiaxu*.

This epoch, which falls in A.D. 794, is used in all the ephemerides except those for Rāhu and Ketu.[8]

As suggested by Yabuuti[9], the numbers given in our text are close to those recorded in the *Wu ji li* 五紀暦[10] which was officially used in China from 762 to ~~A.D.~~ 783.

6. For this interpretation, see Yano, "The Ch'i-yao jang-tsai-chüeh," (1986, p. 32). Yabuuti Kiyosi, *op. cit.* p. 174 interpreted Ketu as the lunar perigee.

7. Yabuuti Kiyosi, *op. cit.* p. 182 suggests that this should be amended to the numeral 34.

8. The epoch for these two imaginary planets is the first year of the Yuanhe era, i.e. A.D. 806.

9. Yabuuti, *op. cit.* p. 182.

10. *Lidai tianwen lüli dengzhi huipian* 7 歷代天文律暦等志彙編七 (The Collected Records on Astrology and Calendrical Astronomy Throughout the Ages, 7), pp. 2292f. In the *Wuji li* some phenomena are further divided. For example, the period of the retrogression of the outer planets (Φ - Ψ) is subdivided into a "first retrogression" *qiantui* 前退 and "second retrogression" *houtui* 後退. In such cases I have put them in a single entry by simply adding the numbers.

Table 1. Jupiter

QR			*Wu ji li*		
	days	degrees		days	degrees
$\Gamma - \Phi$	114	19	$\Gamma - \Phi$	114	$18\frac{289}{335}$
Φ	27		Φ	27	
$\Phi - \Psi$	$82\frac{1}{2}$	-11	$\Phi - \Psi$	82	$-10\frac{325}{335}$
Ψ	27		Ψ	27	
$\Psi - \Omega$	114	19	$\Psi - \Omega$	114	$18\frac{289}{335}$
$\Omega - \Gamma$	34	?	$\Omega - \Gamma$	$34\frac{291}{335}$	$6\frac{291}{335}$
total	$398\frac{1}{2}$		total	$398\frac{291}{335}$	

Table 2. Mars

QR			*Wu ji li*		
	days	degrees		days	degrees
$\Gamma - \Phi$	274	$162\frac{1}{2}$	$\Gamma - \Phi$	274	161
Φ	13		Φ	13	
$\Phi - \Psi$	62	-20	$\Phi - \Psi$	62	$-17\frac{85}{335}$
Ψ	13		Ψ	13	
$\Psi - \Omega$	274	$172\frac{1}{2}$	$\Psi - \Omega$	274	161
$\Omega - \Gamma$	144	?	$\Omega - \Gamma$	$143\frac{310}{335}$	$109\frac{289}{335}$
total	780		total	$779\frac{310}{335}$	

Table 3. Saturn

QR			*Wu ji li*		
	days	degrees		days	degrees
$\Gamma - \Phi$	83	8	$\Gamma - \Phi$	83	$7\frac{102}{335}$
Φ	37		Φ	$37\frac{164}{335}$	
$\Phi - \Psi$	100	-6	$\Phi - \Psi$	100	$-4\frac{294}{335}$
Ψ	37		Ψ	$37\frac{164}{335}$	
$\Psi - \Omega$	83	8	$\Psi - \Omega$	83	$7\frac{102}{335}$
$\Omega - \Gamma$	38	?	$\Omega - \Gamma$	$37\frac{33}{335}$	$3\frac{33}{335}$
total	378		total	$378\frac{26}{335}$	

Table 4. Venus

QR			*Wu ji li*		
	days	degrees		days	degrees
Ξ – Ψ	226	249	Ξ – Ψ	226	249
Ψ	8		Ψ	8	
Ψ – Ω	10	?	Ψ – Ω	10	-5
Ω – Γ	12*	?	Ω – Γ	12	-10
Γ – Φ	10*	?	Γ – Φ	10	-5
Φ	8		Φ	8	
Φ – Σ	226	249	Φ – Σ	226	249
Σ – Ξ	84	?	Σ – Ξ	$83\frac{225}{335}$	$105\frac{225}{335}$
total	584		total	$583\frac{225}{335}$	

*note: Ω – Γ and Γ – Φ are missing in the text.

Table 5. Mercury

QR			*Wu ji li*		
	days	degrees		days	degrees
Ξ – Ψ	27	30	Ξ – Ψ	27	30
Ψ	3		Ψ	3	
Ψ – Φ	22	?	Ψ – Φ	22	-12
Φ	3		Φ	3	
Φ – Σ	27	30	Φ – Σ	27	30
Σ – Ξ	34	?	Σ – Ξ	$33\frac{295}{335}$	$67\frac{295}{335}$
total	116		total	$115\frac{295}{335}$	

Let us compare the numbers given by these two texts. Following O. Neugebauer's convention,[11] I shall use Greek letters to designate the planetary phenomena:

	Superior Planets		Inferior Planets
Γ	reappearance after invisibility	Ξ	reappearance
Φ	first station	Ψ	first station
Θ	opposition	Ω	disappearance
Ψ	second station	Γ	reappearance
Ω	disappearance	Φ	second station
		Σ	disappearance

11. Neugebauer, *A History of Ancient Mathematical Astronomy*, 3 vols. Berlin & New York: Springer-Verlag, 1975, p. 386.

The total number of days in the synodic periods is not explicitly given in the *QR*. I have simply added those numbers given in the table. As is evident from these tables, the numbers in the *QR* were rounded and therefore not very accurate. But the last sentence of each preamble gives the integer number of years (Y) in which the integer number of synodic periods (A) and the integer number of sidereal rotations (R) are completed.[12] Thus we obtain a better synodic period (P) by dividing Y by A. The results are shown in Table 6 and compared with the modern values.

Table 6.

	Y	A	R	P (in days)	
				QR	modern
Jupiter	83	76	7	398.88	398.88
Mars	79	37	42	779.84	779.93
Saturn	59	57	2	378.06	378.09
Venus	8	5	-	584.38*	583.92
Mercury	33	104	-	115.89	115.88

* For the correction see below.

3. Planetary Ephemerides

Since the planetary phenomena were supposed to repeat in the period of years (Y) given in Table 6, the ephemeris of the *QR* has Y columns. Each column is divided into 12 entries corresponding to 12 months beginning with the "standard [first] month" *Zhengyue* 正月. The "month" here is solar, and the beginning of the first month is *yushui* 雨水 when the solar longitude is 330°. Thus the ephemerides were intended to provide the planetary phenomena, their dates, and their positions in each solar month (so called sauramāsa in Sanskrit). If planetary phenomena did repeat in exactly Y years, such tables must have been very useful and could have been used perpetually. Even in that case, however, one had to be familiar with the solar month such as was used, and is still in use, in south India and Nepal. The division of a solar year into 24 equal parts, *jieqi* 節氣, is a similar concept, but the solar month was not used as a time unit for the civil calendar either in China or in Japan.

In the case of Jupiter the synodic period given by the *QR* is quite accurate, so that even in its 15th period, which began on February 20 (*yushui*) of A.D. 1956, the deviation

12. It is worth noting here that the 83, 79, 59, 8 year periods for Jupiter, Mars, Saturn, and Venus, respectively, were used in the "Goal-Year Texts" of Mesopotamia. Cf. Neugebauer, *op. cit.* pp. 554-556.

from the true longitude is only a few degrees. For other planets, however, even a slight difference in one period will result in a significant deviation after several periods.

The author of the *QR*, being conscious of the inaccuracy of the Venus' period, tried to introduce a correction. His general account is difficult to understand, but he gives a clear example:

> If there is an evening appearance (♀) at 13 degrees of *wei* 胃 on the fifteenth day of the third month in the fifth year [of the period], then in the next [period, the same phenomenon will be] on the tenth day of the third month at 12 degrees of *wei*."

If we take this correction (of reducing 5 days in 8 years) into account the synodic period would be 583.39 days, which is, however, still worse.

In Table 7, I have shown the planetary phenomena in the first month of the epoch year as they were recorded in the ephemerides of the *QR*. As the *xiu* coordinates, I have used the polar longitude which I have reconstructed.[13] They are expressed in Chinese degrees.

Table 7.

Jupiter	$\Phi - \Psi$, at *zhang* (張, $132.9^{\circ\circ} \leq \lambda \leq 150.4^{\circ\circ}$)
Mars	Γ, 29th at 14 *wei* (危, $\lambda = 327.0^{\circ\circ}$)
Saturn	$\Psi - \Gamma$, at *mao* (昴, $42.6^{\circ\circ} \leq \lambda \leq 53.2^{\circ\circ}$)
Venus	Ψ, 19th evening at 9 *gui* (圭, $\lambda = 4.9^{\circ\circ}$) and retrogression
Mercury	Ξ, 22nd evening at 8 *bi* (壁, $\lambda = 360.1^{\circ\circ}$)

If we compare them with the longitude computed by modern astronomy (Table 8)[14], they are quite well within an accurate range.

Table 8. Planetary position at the epoch
(A.D. 794 Feb.14 UT 0)

	λ°	$\lambda^{*\circ}$	$\lambda^{\circ\circ}$
Jupiter	143.23	143.72	146.1
Mars	308.74	309.03	311.5
Saturn	47.66	48.20	45.7
Venus	4.19	1.53	1.4
Mercury	329.98	330.64	332.7

13. See Yano Michio, "The Ch'i-yao jang-tsai-chüeh", p. 30.

14. I used a computer program devised by Prof. K. Furukawa.

λ° : ecliptic longitude
λ*°: polar longitude
λ°°: polar longitude in Chinese degrees

4. User(s) of the Ephemerides

It is interesting to know that the ephemerides which were computed for the period of several decades around 800 was transmitted to Japan and used by the Buddhist astrologers three centuries later.

On the top margin of the ephemerides, just above the serial number indicating the year within the period, one or two 60-year cycle names are added almost without interruption. In the case of the ephemeris for Jupiter, for example, on the margin of the first year are written "Kibi" (癸未) and "Heigo" (丙午), corresponding to 1043 and 1126 respectively. There are 47 cases where years in Japanese eras are also given. Almost all these years fall in the eleventh to twelfth centuries. In Table 9, all the Japanese years in the margin are listed.

From this list we may draw following conclusions:

1. It was because the ephemeris of Jupiter was comparatively reliable that more Japanese years were put on the margin of the ephemeris for Jupiter than of the other planets.
2. The first years of the Japanese eras were frequently indicated on the margin to facilitate determining the correspondence between Japanese eras and planetary periods.
3. There was an astrologer who used these ephemerides in order to cast a horoscope sometime in the second year of Genei (1119) and, probably, in the first year of Enkyu (1069).

The Buddhist school of astrology called Sukuyôdô 宿曜道 was in fashion in the last half of the Heian period (794 - 1192). The horoscope astrology of this school, having originated in Mesopotamia and the Hellenistic world and been transmitted from India to Japan by Buddhism, was quite novel to intellectuals in the Heian court. At one time this school competed with the Onmyôdô 陰陽道 — traditional school of Chinese astrology. But this school did not have powerful tools for computing the planetary positions. For a while some astrologers resorted to the *Qiyao rangzai jue*,[15] but it was not long before they knew that the ephemerides could not be used eternally. Then at the end of the Heian period the school began losing popularity. But the text of the *QR* was carefully preserved in the Tantric Buddhist temples, because it was considered to be one of the sacred Buddhist texts. When the *Taishô Daizôkyô* was compiled in the early twentieth century, a manuscript from one of the temples was used. But the compilers never knew the significance of this text.

15. Another text which might have been used for this purpose was the *Fu tian li*. Cf. Nakayama Shigeru 中山茂, "*Futenreki* no temmongakushiteki ichi" 符天暦の天文学史的位置 ("The Significance of the *Fut'ien li*, in the History of Astronomy"), *Kagakushi kenkyû* 科学史研究 vol. 71 (1964), pp. 120-123.