SCIENCES, TECHNIQUES ET INSTRUMENTS DANS LE MONDE IRANIEN (X^e - XIX^e SIÈCLE)

Études réunies et présentées

par

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THE ACTIVITIES OF IRANIAN ASTRONOMERS IN MONGOL CHINA

INTRODUCTION

In the second half of the 13th century both the Iranian part of the Islamic world and China were part of the Mongol world empire. After the defeat of the Abbasid dynasty in 1258, Hūlāgū Ḫān, grandson of Čingiz, founded the Ilkhanate, which covered most of Iraq and Iran. Some years later, Hūlāgū's brother Qubilay became the first emperor of the Mongolian Yuan dynasty in China. Between 1260 and 1270 in particular, tens of thousands of Muslims arrived in China and served in the Mongol administration or worked as scholars and artists. At the same time scientific exchange took place between the Ilkhanate and the Yuan dynasty.

A Chinese astronomer Fu Mengchi (or Fu Muzhai) is known to have been active at the astronomical observatory near the Ilkhan capital, Maragha, in northwestern Iran. This observatory was founded by Hūlāgū in 1259 on the instigation of its first director, the famous scholar Naṣīr al-Dīn al-Ṭūsī.[1] It is very probable that Fu Mengchi exerted a large influence on the descriptions of the so-called Chinese-Uighur calendar found in many Iranian *zīj*es (astronomical handbooks with tables, Persian *zīg*) from the Mongol period.[2]

In 1267 a Muslim astronomer called Zhamaluding (Chinese transliteration of Jamāl al-Dīn) arrived in the Chinese capital, Beijing, and presented to the emperor a number of typical Islamic astronomical instruments as well as a *zīj*. Four years later Zhamaluding became the first director of the newly founded Islamic Astronomical Bureau with Observatory, which operated parallel to the Chinese Imperial Astronomical Bureau. Since the staff of the Islamic Astronomical Bureau, including astronomers, teachers and administrative personnel, numbered nearly forty, it seems possible that a large-scale

1. For more information on the astronomical observatory in Maragha the reader is referred to Sayılı 1960, Chapter 6. The name of the Chinese astronomer active at the observatory is mentioned by the contemporary astronomer al-'Urḍī and by the historian Banākatī; see Boyle 1963, p. 253, note 4.
2. The Chinese-Uighur calendar, which is of lunisolar type, was a mixture of the official Chinese calendar of the Jin Dynasty, which was defeated by the Mongols in AD 1215, and certain elements from "inofficial" Chinese calendars. One of the latter may have been the calendar used by the Uighurs, who started to serve the Mongol administration around AD 1210. The technical details of the Chinese-Uighur calendar are discussed in van Dalen et al. 1997, whereas its use in historical sources from thirteenth and fourteenth-century Iran is described in Melville 1994.

observational programme was carried out there. The Chinese historical sources, foremost the *Yuanshi*, the official annals of the Yuan dynasty, contain little information on the Islamic Astronomical Bureau and even less about its activities. In fact, they only mention a geographical survey carried out under Zhamaluding's direction between 1286 and 1291.[3] Therefore, the scope of the astronomical activities by Muslims in Yuan China must be judged from a number of astronomical works dating from AD 1366 and later. These include the following:[4]

1. The *Huihui li* ("Islamic astronomical system", or simply "Islamic calendar"). This is a Chinese translation of a typical Islamic *zīj* made at the Astronomical Bureau of the Ming dynasty (1368-1644) in Nanjing in 1383. The *Huihui li* is extant in three different reworkings:
   a) The *Huihuilifa* ("Islamic astronomical system") is a restoration of the original translation prepared in 1477 by Bei Lin, vice-director of the Astronomical Bureau of the Ming dynasty in Nanjing. The original printing of the *Huihuilifa* is still available in Tokyo (complete) and in Beijing (without tables). Both text and tables are now easily accessible in the facsimile edition of the huge literary collection *Sikuquanshu* from the late 18th century. In this collection the *Huihuilifa* was renamed *Qizhengtuibu* ("Calculation of the Motion of the Seven Luminaries"), apparently because some of the copies consulted did not have a title. The *Huihuilifa* can be assumed to be the extant version of the *Huihui li* closest to the original Chinese translation of 1383.
   b) The *Chiljongsan* ("Calculation of the Seven Luminaries") is a Korean reworking made on the order of King Sejong in the year 1442. It was printed as a separate work and again as part of the *Sejong Sillok* ("Veritable Records of King Sejong"), the royal annals. In both versions, the tables are almost error-free and can be assumed to be basically identical with the original tables of the *Huihui li*; the text was rewritten and adjusted for use in Seoul.
   c) The version contained in the *Mingshi*, the official annals of the Ming dynasty that were finally printed in 1739, was severely shortened and omits, among other things, the mean motion tables and the star catalogue.
2. An Arabic *zīj* written by a certain al-Sanjufīnī in 1366 and dedicated to the Mongol viceroy of Tibet. The unique manuscript, now in the Bibliothèque nationale de France (arabe 6040) but previously in a Chinese library, includes Tibetan transliterations of month-names and Mongolian translations of the titles of tables. It includes various tables for typically-Chinese

3. See Tasaka 1957, pp. 78-79. The available information on the Islamic Astronomical Bureau was collected in various publications of Yabuuti, in particular 1954, 1987 and 1997.
4. More extensive discussions of the available sources related to Islamic astronomy in China can be found in the works by Yabuuti mentioned in footnote 3 and in van Dalen, 2002b.

astronomical topics, such as the 24 equal divisions of the solar year (the so-called *qi*) and the Chinese version of the lunar mansions. It has nearly twenty tables in common with the *Huihui li* and some more tables that either were derived from tables in the *Huihui li* or can be seen to have been the original from which certain tables in the *Huihui li* were computed.

In his publications mentioned in footnote 3, Yabuuti described the contents of the *Huihui li* in detail and noted that it is based almost completely on Ptolemy's geocentric, geometrical models for planetary motion. In recent years, Prof. Michio Yano (Kyoto Sangyo University) and the present author have extended the research on the *Huihui li* to comparisons with Islamic astronomical handbooks in Arabic and Persian. One of our conclusions is that the *Huihui li* and the *Sanjufīnī Zīj* depended on an earlier Persian work that was highly original as far as both the set-up of its tables and the underlying parameter values are concerned and which was very probably the result of an extensive observational programme carried out by the Muslim astronomers in Beijing in the last third of the 13th century. Of particular interest is the star catalogue in the *Huihui li*, which is one of only two Islamic star catalogues that were based on new observations rather than directly on the coordinates in Ptolemy's *Almagest* and also the earliest work giving a correspondence between Ptolemaic and Chinese star-names. Although certain information in the extant versions of the *Huihui li* described above point to an observational date in the early Ming dynasty, the possibility that the star catalogue was a product of Muslim activities during the Yuan dynasty cannot be excluded.

An article by A. Wagner in the journal *Copernicus* of 1882 describes two manuscripts that could not only confirm the above conclusions but also provide important additional information about the original work compiled by the Muslim astronomers in Yuan China and the earliest history of the Chinese translation (i.e., before the reworking by Bei Lin). These manuscripts, one in Arabic or Persian containing only tables and one in Chinese, had been obtained in China and were kept in the library of the Pulkovo Observatory near St. Petersburg. In spite of the helpfulness of Dr. Günther Oestmann (Hamburg) and Dr. Sergei Tourkin (St. Petersburg), I have not been able to discover the present whereabouts of the manuscripts and it seems possible that they were lost. However, Wagner's description leaves no doubt that the tables in the Arabic or Persian manuscript are basically the same as those in the *Huihui li* and hence that very probably this manuscript, which Wagner dated to the twelfth century on paleographical grounds, contained a copy of the original *zīj* compiled by the Muslim astronomers in Yuan China.[5]

5. Preliminary results of the researches by Yano and the present author can be found in Yano 1999 and 2002, van Dalen 1999 and 2002a. A complete edition of the star catalogue with a discussion of some of its interesting astronomical and philological aspects is contained in van Dalen 2000. An edition and translation of the text of the *Huihui li* with a transcription of the tables and commentary is

IRANIAN ASPECTS OF ISLAMIC ASTRONOMY IN CHINA

For historical reasons it is plausible that the Muslim astronomers active in Mongol China were Iranians, or at least that they worked in Persian and in the Iranian scientific tradition. Not only did the contacts of the Mongols with the Muslim world go mainly through Iran, but it is also known that most of the tens of thousands of Muslims who arrived in China in the 1260s and 1270s were Iranians. Since many of them were employed by the Mongols, Persian in fact became the most important language of the Mongol administration in China.[6]

However, the extant Chinese translation of the Islamic astronomical handbook compiled in the early Yuan dynasty, the *Huihui li*, and other scattered information on the astronomical activities of Muslims in China also show traces of decidedly Iranian influences. These are, in particular, the use of a true solar calendar which is very similar to some of the calendars traditionally used in Iran, and the Chinese transliterations of the Persian names of the instruments brought to China by Zhamaluding, of the titles of the "western" books available at the Islamic Astronomical Bureau in Beijing, and of the Persian names of the months and days of the week as presented in the *Huihui li*. These aspects will now be discussed in more detail.

True solar calendar based on the vernal equinox

Iranian calendars traditionally define New Year (Nowrūz) as the day on which the sun reaches the vernal equinoctial point. Calendars of this type are called "true solar calendars" because they are based on the actual time of the vernal equinox rather than on a simplified intercalation scheme (both the Julian and the Gregorian calendar make use of such a simplified scheme). The most well-known Iranian true solar calendar is called *Jalālī* of *Malikī* after the Saljuq sultan Jalāl al-Dawla Malikšāh who introduced it in AD 1079. It was originally set up to be used with true solar months corresponding precisely to the time spent by the sun in the consecutive zodiacal signs, but in practice it was more often used with twelve months of 30 days followed by 5 of 6 epagomenal days (cf. the articles "Djalālī" and Ta'rīkh" in the *Encyclopaedia of Islam, new edition*).

In a number of paragraphs in the first chapter of the introduction to the *Huihui li* a solar year is defined which is very similar to the original form of the Jalālī calendar:[7]

currently being prepared by the present author. The Korean version of the *Huihui li* was studied in more detail in Shi 2003.

6. The role of the Muslims in Mongol China is investigated in various contributions to Langlois 1981, in particular in Morris Rossabi, "The Muslims in the Early Yüan Dynasty", pp. 257-295. See also Chen 1989 and Allsen 1983.
7. Cf. Yabuuti 1997, pp. 20-22. In this section, references to the *Huihuilifa* are to the original printing of the restoration by Bei Lin which is extant as *zi* 51-3 / Chinese 15773 in the National Archives of Japan (Kokuritsu Kobunshokan Naikaku Bunko) in Tokyo. For the sake of convenience, the corresponding sheet and column numbers of the *Qizhengtuibu* as reproduced in the facsimile edition of the Wenyuange copy of the *Sikuquanshu* (published by Shangwu Yinshuguan, Taipei 1983-1986) are also given. References to the *Mingshi* are to the facsimile edition printed by Yiwen Yinshuguan, Taipei 1956; the reader may also want to consult the edition more recently published in Beijing by Zhonghua Shuju, in the series *Mingshi*, vol. 3 (1974), pp. 745-880 as well as in the series *Lidai tianwen luli dengzhi huibian*, vol. 10 (1976), pp. 3755-3879. The notation *v* : *s* col. c indicates sheet no. *s* of volume no. *v*, col. *c*.

- The months of the year are named after the zodiacal signs. Starting from Aries they have the following numbers of days: 31, 31, 31, 32, 31, 31, 30, 30, 29, 29, 30, and 30; in a leap year the last month, Pisces, receives 31 days. These numbers of days are found explicitly in the *Huihuilifa* (1:1 cols. 10-15), the *Qizhengtuibu* (1:1 col. 12-1:2 col. 1) and the *Mingshi* (37:2 cols. 15-19). Furthermore, they are implicit in the mean motion tables for zodiacal signs in the *Sanjufīnī Zīj* (ff. 35v and 46v) and the Pulkovo manuscript (Wagner, p. 125). However, in the latter two sources the traditional Persian month-names are used instead of the zodiacal signs. In the *Huihuilifa* (1:1 col. 20-1:2 col. 8) and *Qizhengtuibu* (1:2 cols. 6-16) the Persian month-names are erroneously used for the Arabic lunar months; since the Pulkovo manuscript uses both the Arabic lunar months and the Persian solar months with the correct numbers of days, we may assume that this mistake was made either by the translators of the *Huihui li* in the early Ming dynasty or by Bei Lin.
- Of each cycle of 128 solar years, 31 are leap years. This follows from a rule for determining whether a given year is a leap year or not in a paragraph entitled *Finding the Leap Days of the Zodiacal Signs* (*Huihuilifa* 1:2 cols. 14-19, *Qizhengtuibu* 1:3 cols. 6-11, *Mingshi* 37:3 cols. 7-12; cf. Yabuuti 1997, p. 21). Since the calendar-dependent tables in the Pulkovo manuscript as described by Wagner are all based on the lunar calendar, no information about the leap years in the solar calendar can be obtained from this source at present. However, the *Sanjufīnī Zīj* contains tables for true solar positions and mean planetary positions at the beginning of 128 consecutive solar years (ff. 32v-34r and 44v-46r; the solar new year is indicated with the Arabic *nayrūz* instead of the Persian *now-rūz*); in that range, precisely 31 years are leap years. Furthermore, the solar motion over the whole period is in precise agreement with what one finds from the mean motion tables in the *Huihui li*.[8]

8. The tables for solar mean motion in the *Huihui li* are based on a round length of the solar year of $365^{d}\ 5^{h}\ 48^{m}\ 46^{s}$. The intercalation pattern of 31 leap days in 128 years leads to a mean motion which is only slightly different from this value, namely by 5 seconds in one intercalation cycle of 128 years. Neither the year-length of the *Huihui li* nor the daily mean motion calculated from the intercalation cycle of 128 years occurs in a database of Islamic astronomical parameters that was built up by Professor E.S. Kennedy and has partially been made available on the internet by the present author. This implies, in particular, that the parameters underlying the tables in the *Huihui li* are different from those in the contemporary works resulting from the activities at the Ilkhan observatory in Maragha, namely the *Īlḫānī Zīj* by al-Ṭūsī (which was not based on the new observations made at the observatory) and the *Advār al-Anvār* by al-Maġribī. This supports our thesis that the Huihui li was an independent work based on new observations carried out at the Islamic Astronomical Bureau in Beijing.

In his *zīj*, al-Sanjufīnī reckoned the true solar years from an epoch called after Čingiz Ḫān, namely, the vernal equinox of AD 1207. The leap years in his mean motion tables, which cover the range of solar years from the year 157 Ḫānī (AD 1363) to 284 Ḫānī (AD 1490), correspond to the following Julian years: 1363, 1367, 1371, 1375, 1380, 1384, 1388, ..., 1404, 1409, 1413, ..., 1437, 1442, 1446, ..., 1470, 1475, 1479, 1483, and 1487. This can be summarized by saying that the leap years following *four* ordinary years (instead of the usual *three*) are 1380, 1409, 1442, and 1475.

To determine the location of the leap years in the *Huihui li*, we have to apply the rule mentioned above. The introductory text of the *Huihui li* implies that the solar years are counted from the vernal equinox of the Chinese year *ji-wei* of the reign period of Emperor Kai Huang of the Sui dynasty, which corresponds to AD 599 (*Huihuilifa* 1:1 cols. 6-8, *Qizhengtuibu* 1:1 cols. 8-10, *Mingshi* 37:2 col. 5; for an explanation of this curious epoch, see below). We then find that in the *Huihui li* the Julian years 1354, 1383, 1416, and 1449 follow four ordinary years instead of three. Thus, in comparison with the *Sanjufīnī Zīj*, these years fall 26 years earlier.

In spite of this difference, both sets of leap years can in fact be derived from the tables for solar motion in the *Huihui li* by calculating the precise times of respective vernal equinoxes. It turns out that the difference in the location of the leap years has two causes. Firstly, the tables for planetary mean motion in the *Sanjufīnī Zīj* were intended for use in Yongchang-fu, seat of a Mongol prince in northeastern Tibet, which lies 14¼ ° west of Beijing. The latter is presumably the base location of the Persian original of the *Huihui li*, which itself prescribes corrections to the planetary mean motions corresponding to a shift in geographical longitude of approximately 4½ ° eastwards, somewhat too large for Nanjing. Secondly, it seems that different criteria for the insertion of the leap day at the end of the solar year were used. The rules in the *Huihui li* insert a leap day if the vernal equinox falls before midnight of the day following the 365th day of the year (here a day is assumed to start at noon). On the other hand, the method implicit in the *Sanjufīnī Zīj* inserts the leap day if, at noon of the day following the 365th day of the year, the sun is still more than $^3/_4$° away from the vernal equinoctial point, i.e. roughly if the vernal equinox falls before sunset of the day following the 365th day of the year. The first of these two criteria is the one used with the tables for the Jalālī calendar in most Arabic and Persian *zīj*es.

Note that it follows from the above that the difference between the intercalation schemes in the *Sanjufīnī Zīj* and the *Huihui li* is **not** related to the confusion of the solar and lunar epochs that has taken place in the *Huihui li*. As has been noted by various scholars, the epoch AD 599 given in all extant sources derives from misinterpreting the 786 Hijra years that had accumulated by AD 1384 (the beginning of the Chinese sixty-year cycle closest to the time of the translation) as solar years (AD 1384 - 785 completed solar years = AD 599). Since the year 599 is explicitly mentioned in each source for the *Huihui li* including the Korean *Chiljongsan*, we may assume that this mistake originated in the Chinese translation from the early Ming dynasty. If the Persian original of that translation contained an intercalation rule for a solar calendar with Hijra epoch, this same rule applied to the shifted epoch in the *Huihui li* would shift all leap years 23 years backwards. A shift of 26 years would occur if the same rule were applied to an erroneous solar epoch that makes the number of elapsed solar years equal to the number of elapsed Hijra lunar years around the year 1475, i.e. the time in which Bei Lin restored the *Huihui li*. However, since also Bei Lin explicitly mentions the year 599 as epoch, this can not have been the cause of the shift in the leap years.

Chinese transliterations of Persian words

In Chinese sources we find transliterations of the names of the instruments presented by Zhamaluding to Qubilay Ḫān, of the titles of the books available at the Islamic Astronomical Bureau, and of the names of the Persian months and the days of the week. In general these transliterations are quite accurate and in many cases it is clear that the language from which they were made was Persian rather than Arabic. This can be seen, in particular, from the consistent omission of the Arabic article *al-*, from the occurrence of an *iḍāfa* in most constructs (except possibly *ḏātu l-halaq* and *ḏātu l-šu'batayn* in Table 1 below), from some words that occur in Persian in forms slightly different from the Arabic (e.g. *usṭurlāb* instead of *asṭurlāb* for "astrolabe", *ṭabb* instead of *ṭibb* for "medicine", and *parkār* instead of *birkār* for "compass"), and perhaps from the transliteration of the letter *ḍal* with Chinese *zi* in the word *arḍ*.

It seems most probable that the transliterations were made in oral communication between Persian-speaking members of the Islamic Astronomical Bureau and Chinese scribes. In the case of the instruments and book titles, the original sources for the transliterations can be assumed to date from the early Yuan dynasty, the period in which the Islamic Astronomical Bureau flourished; the transliterations are now extant in sections of the official annals of the Yuan. In the case of the Persian months and days of the weeks, the transliterations are contained in the reworking of the *Huihui li* by Bei Lin and probably date from the early Ming dynasty, the time in which the *Huihui li* was translated into Chinese. The transliterations as they are extant are presumably rather accurate copies of the original transliterations since the sources in which they are contained were not continuously re-edited.

A thorough investigation of the transliterations, presented in Tables 1 to 4 below, is beyond the scope of this article. It is rather hoped that the material presented here will whet the appetite of Iranologists with knowledge of Arabic and Persian scientific terminology to explain the transliterations that earlier investigations left open. Among these investigations, the first we should

mention is that of Tasaka (1957, originally published in Japanese in 1942), who made systematic use of the Persian-Chinese vocabularies contained in the *Huayi yiyu* ("Chinese-Foreign Glossaries", 14th century) and various other works, but was insufficiently familiar with Arabic and Persian technical terminology. Later studies by Hartner (1950) and Miyajima (1982) dealt specifically with the instruments presented by Zhamaluding. The transliterations of the names of those instruments and of the Persian month-names were also listed by Yabuuti (1997).

Table 1: The Astronomical Instruments Presented to Qubilay Ḫān by Zhamaluding

The names of these instruments, with brief descriptions, are listed in vol. 48 (i.e. vol. 1 of the Astronomical Annals) of the *Yuanshi*, the official history of the Yuan dynasty. They were first analysed in Tasaka 1957 (translated from the Japanese original of 1942), pp. 76-99 and Hartner 1950. By taking into account the complete descriptions of the instruments, Miyajima 1982 made various improvements to the identifications. Yabuuti 1997, pp. 14-16, summarized the results of the earlier investigations.

Chinese		*Persian*	*translation*
咱禿哈剌吉	*za-tu-ha-la-ji*	*dātu l-ḥalaq*	armillary sphere
咱禿朔八台	*za-tu-shuo-ba-tai*	*dātu l-šuʿbatayni*	parallactic ruler
魯哈麻亦渺凹只	*lu-ha-ma-yi-miao-wa-zhi*	*ruḫāma-yi muʿwajj*	sundial building for the equinoxes
魯哈麻亦木思塔餘	*lu-ha-ma-yi-mu-si-ta-yu*	*ruḫāma-yi mustawī*	sundial building for the solstices
苦來亦撒麻	*ku-lai-yi-sa-ma*	*kura-yi samāʾ*	celestial globe
苦來亦阿兒子	*ku-lai-yi-a-er-zi*	*kura-yi arḍ*	terrestrial globe
兀速都兒剌不	*wu-su-du-er-la-bu*	*usṭurlāb*	astrolabe

Table 2: The Scientific Books and Instruments at the Islamic Astronomical Bureau

A list of 22 books, 1 map and 3 instruments present at the Islamic Astronomical Bureau and the residence of its director Zhamaluding in the year 1273 is contained in the chapter "Officials Belonging to the Astronomical Bureau" of the *Annals of the Yuan Imperial Library*. For each book and instrument a brief description in Chinese is also given, which in many cases facilitates the interpretation of the transliteration. All 26 items were extensively

discussed in Tasaka 1957, pp. 99-119. The table below is a selection (numbered in agreement with Tasaka) containing some corrections by the present author. The last two items are instruments.

no.	*Chinese*		*Persian*	*translation*
1	兀忽列的	*wu-hu-lie-di*	*uqlīdi[s]*	Euclid (*Elements*)
3	撒唯那罕答昔牙	*sa-wei-na han-da-xi-ya*	*? handasīya*	geometrical ?
4	麥者思的	*mai-zhe-si-di*	*majisṭī*	Ptolemy's *Almagest*
7	麻塔合立	*ma-ta-he-li*	*madḫal*	Kūšyār's *Astrology*[9]
8	海牙剔	*hai-ya-ti*	*hayʾat*	astronomy, cosmology
10	積尺	*ji-chi*	*zīj* or *zīč*	astronomical tables
11	速瓦里可瓦乞必	*su-wa-li-ke-wa-qi-bi*	*ṣuwar-i kawākib*	al-Ṣūfī's book on stellar constellations
12	撒那的阿剌忒	*sa-na-di-a-la-te*	*ṣanʿat-i ālāt*	construction of instruments
15	忒畢	*te-bi*	*ṭabb*	medicine
17	帖里黑	*tie-li-hei*	*taʾrīḫ*	chronology
21	黑牙里	*hei-ya-li*	*ḥiyāl*	ingenious devices
24	阿剌的殺密剌	*a-la-di-sha-mi-la*	*ālat-i šāmila*	horizontal sundial
26	拍兒可兒潭	*pai-er-ke-er-tan*	*parkār[-i] tāmm*	perfect compass

Table 3: The Persian Months

The Persian month-names are listed in the first chapter of the *Huihui li* (*Huihuilifa* 1: 1 col. 21-1:2 col. 4 and *Qizhengtuibu* 1:2 cols. 7-12). However, in both sources they are erroneously associated with the Islamic lunar calendar. They were discussed in Tasaka 1957, pp. 148-151 and again listed in Yabuuti 1997, p. 21.

Chinese		*month*
法而斡而丁	*fa-er-wo-er-ding*	Farwardīn
阿而的必喜世	*a-er-di-bi-xi-shi*	Ardī bihišt
虎而達	*hu-er-da*	Ḫurdād
提而	*ti-er*	Tīr
木而達	*mu-er-da*	Murdād
沙合列斡而	*sha-he-lie-wo-er*	Šahrīwar
列 (別?) 黑而	*lie(bie?)-hei-er*	Mihr
阿斑	*a-ban*	Ābān
阿咱而	*a-za-er*	Āḏar
答亦	*da-yi*	Day
八哈慢	*ba-ha-man*	Bahman
亦思番達而麻的	*yi-si-fan-da-er-ma-di*	Isfandārmuḏ

9. This work is listed as a book on astrology. It can be assumed to be *al-Madḫal fī at Aḥkām al-Nujūm* by Kūšyār ibn Labbān al-Gīlānī, since this work was translated into Chinese at the same time and by the same scholars as the *Huihui li*; see Yano 1997.

Table 4: The Days of the Week

Also the days of the week are listed in the *Huihui li* (*Huihuilifa* 1:2 cols. 10-12 and *Qizhengtuibu* 1:3 cols. 2-4). They were discussed in Tasaka 1957, p. 153.

Chinese		*Persian*	*day*
也閃別	*ye-shan-bie*	*yak-šanbih*	Sunday
都閃別	*du-shan-bie*	*dū-šanbih*	Monday
寫閃別	*xie-shan-bie*	*sih-šanbih*	Tuesday
察兒閃別	*cha-er-shan-bie*	*čahār-šanbih*	Wednesday
盤閃別	*pan-shan-bie*	*panj-šanbih*	Thursday
阿的那	*a-di-na*	*ādīna*	Friday
閃別	*shan-bie*	*šanbih*	Saturday

CONCLUSION

In this article we have studied some distiguishedly Iranian influences in the *Huihui li*, an astronomical handbook (*zīj*) compiled by Muslim astronomers in Yuan China in the late thirteenth century and translated into Chinese one hundred years later in the early Ming. We have seen that true solar calendar used in this work is very similar to the Iranian Jalālī calendar established by Malikšāh in AD 1079, although it also has its own peculiar characteristics, as much of the contents of the *Huihui li*. Furthermore, the transliterations of month-names and days of the week that occur in the Chinese translation of the *Huihui li*, as well as those of the names of books and instruments found in contemporary Chinese sources, were clearly made from the Persian (rather than from the Arabic). Some of these transliterations, which have been listed in four tables, remain to be explained.

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