

## CHINESE RECORDS OF THE 1874 TRANSIT OF VENUS

Lingfeng Lu and Huifang Li

Department of History of Science and Scientific Archaeology, University of Science and Technology of China, Hefei, People's Republic of China.  
E-mails: lingfeng@ustc.edu.cn; huifang@ustc.edu.cn

**Abstract:** Before the advent of radar, transits of Venus were very important for measuring the distance between the Earth and the Sun. A transit occurred in 1874, and was visible from China, other parts of east and southeast Asia and from India, Australia and New Zealand and certain islands in the Indian and Pacific Oceans. As a result, many astronomers from Western countries came to China to observe it. According to traditional Chinese astrology, the Sun represented the Emperor, and if the Sun was invaded by other astronomical bodies it meant that the Emperor and the country faced some ominous disaster. In the late nineteenth century, Western astronomical knowledge was widely translated into Chinese and spread among Chinese intellectuals, so the 1874 transit supposedly was easily understood by Chinese intellectuals. Before the transit took place, various Chinese publications introduced this kind of celestial event as science news, but at the same time other influential newspapers and journals discussed the astrological connection between the transit and the fortunes of the nation. In this paper we review these interesting Chinese records and discuss the different attitudes towards the transit exhibited by Chinese intellectuals and officials, during a period when Western learning was being widely disseminated throughout China.

**Keywords:** 1874 transit of Venus transit, China, the *Peking Magazine*, W.A.P. Martin, James Craig Watson

### 1 INTRODUCTION

Once Edmund Halley demonstrated that transits of Venus could be used to address that fundamental challenge of astronomy, determining the distance from the Earth to the Sun (i.e. the 'astronomical unit'), these rare events assumed immense international importance. The 1761 and 1769 transits produced discordant results (see Woolf, 1959), which directed attention to the two nineteenth century transits, in 1874 and 1882 (e.g. see Sheehan and Westfall, 2004).

As shown in Figure 1, the entire 1874 transit was visible from China, India and Japan in the Northern Hemisphere; from Australia New Zealand and isolated islands in the Indian Ocean in the Southern Hemisphere; and from islands in the Pacific Ocean in both Hemispheres. Consequently, eclipse expeditions from England, France, Germany and the USA were attracted to these na-

tions and to various islands in the Indian and Pacific Oceans (e.g. see Chauvin, 2003; Dick et al., 1998; Duerbeck, 2007; Lauga, 2004; Launay, 2012; Orchiston, 2004; Pigatto and Zanini, 2001; Ratcliff, 2008).

Astronomers from many countries, including England, France and the USA, enthusiastically came to China and other East Asian countries in order to observe the transit, and they established observing stations in cities such as Peking (present day Beijing), Tianjin and Qingdao. Britain even sent a team to observe from the Himalayas. The USA invested a great deal of money in the transit observations, and began their preparations ten years before the event (see Dick et al., 1998). The Americans also invented new types of instruments with which to carry out the observations, especially ones that relied on newly-invented photographic technology.

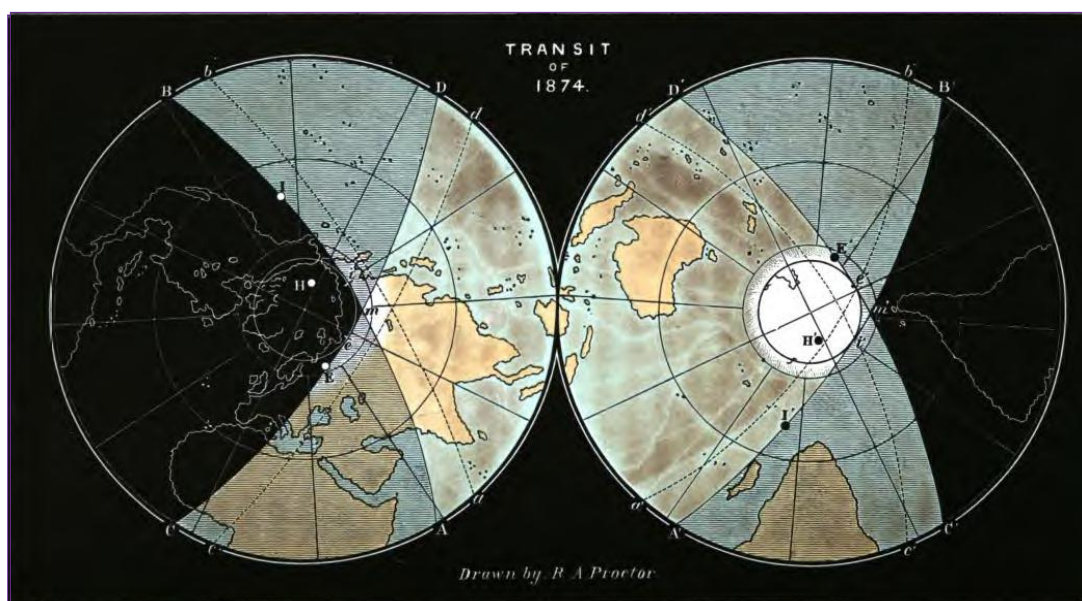


Figure 1: Map showing those areas of the globe (in pale blue and mottled brown) where all of the 1874 transit of Venus would be visible (after Proctor, 1874: Plate VI).

Unfortunately, officials from the Qing Dynasty did not make any records of the transit (wrongly believing that it would occur at night), but some local newspapers and magazines produced by Western cultural and religious institutions and controlled by missionaries published detailed useful information for those who wished to observe the transit. These same newspapers also reported some interesting responses from the visiting Western astronomers, from intellectuals and from common people, both before and after the transit.

In recent years, historians of astronomy have conducted considerable research on the historic transits of Venus (e.g. see the Bibliography in Sheehan and Westfall, 2004), but transit observations from China have not featured in this research. It is hoped that this paper will be viewed as a first step in this direction.



Figure 2: William Alexander Parsons Martin (en.wikipedia.org).

## 2 PUBLICISING THE TRANSIT

One year before the 1874 transit of Venus, the *Peking Magazine*<sup>1</sup> provided background knowledge of this rare astronomical event. The October 1873 issue of the *Peking Magazine* included the following article titled “Transit of Venus” by William Alexander Parsons Martin (1827–1916; Figure 2), a co-founder of the *Magazine*:

Venus will cross the Sun on the 30th day of the 10th month next year in the Chinese lunisolar calendar. The phenomenon will be seen again in 8 years time but will never be observed thereafter [during our lifetime]. Western countries are sending professional astronomers to observe in various places. The Russians are going to the north. The British are going to the south. These kinds of expeditions also occurred in ancient China. For instance, Emperor Yao sent his minister to western and southern China to make accurate observations and measurements of astro-

nomical phenomenon for a time service. Western astronomers are going to places with harsh climates to observe the transit. If you think their purpose is for astrology and the prediction of disasters and fortune, you are totally wrong. Westerners don't use astronomical phenomena to predict the future. The reason why they carry out these observations is so that they can use the data to calculate the distance between the Sun and the Earth. First, during the reign of Hongzhi in the Ming Dynasty Copernicus demonstrated the Heliocentric Theory and declared that the distance between the Sun and the Earth was only 600 times the diameter of the Earth. Then in the reign of Tianqi, Kepler stated that the distance was more than 1700 times the diameter of the Earth. During the reign of Kangxi, Newton proclaimed that the distance was 8000 times the diameter of the Earth. Nowadays we believe it is 11000 times or 12000 times the diameter of the Earth. The diameter of the Earth is 8000 miles ... It seems like the distance between the Earth and the Sun is getting larger. Actually it is because technology and calculations are more advanced nowadays. Astronomers believe that the distance is between these two values and that up-coming observations of the transit of Venus will provide a more precise figure. If the distance between the Earth and the Sun can be calculated, the distance between the Earth and other planets can then be determined. As a result, the distance between the Earth and the Sun is a basic yardstick for all astronomical determination. And the calculation of the distance between the Earth and the Sun relies on observations of the transit of Venus ... (Martin, 1873; our translation).

This article discussed the preparations being made by observing teams from other countries and acknowledged the importance of the transit to Western science. It introduced the means of calculating the distance between the Sun and the Earth. And the “... method of taking photographs ...” (ibid.), the technique that would be used during the transit, also was discussed in the magazine. The use of photography during the 1874 transit was an important innovation (see Lankford, 1987).

Over the following months, the *Peking Magazine* provided more news about the transit of Venus. The 21<sup>st</sup> issue, in April 1874, and the 24<sup>th</sup> issue, in July 1874, reported on the preparations by France (Martin, 1874d) and the United States. For instance, the article “Another item of news on America” reported that the United States would invest a significant amount of money in the observations and would send professional astronomers and photographers to the Eastern Hemisphere:

The news of the transit of Venus has been reported in earlier issues. And now it is said that the Americans will send people to eight places. Five of them are located to the south of

the Equator. The names of the places are unknown. Three of them are located to the north of the Equator. The locations are Nagasaki in Japan, a Russian site to the north of North Korea and the capital of China. It is planned that to each location will be sent one chief professor and five assistants. And the instruments used to make the observations have been produced. To equip the expeditions, the American National Treasury intends to invest 1.5 million [dollars] on these expeditions. Now all the professionals are in training with their equipment and they will soon leave the USA. (Martin, 1874b; our translation).

In the 25<sup>th</sup> issue, in August 1874, the *Peking Magazine* reported more news about the transit, including the forecast from the American astronomer James Craig Watson (1838–1880), who was Professor of Astronomy at the University of Michigan (Comstock, 1895) and leader of the U.S. transit expedition based in Peking:

The transit of Venus [of 1874] is a significant event for astronomy and will be the only one seen from China within a hundred years. A transit is related to the calculation of the distance between the Sun and the Earth. As a result, Western countries pay a lot of money to go to various places to observe it. One reason why they go to different places that are far away from each other is because the further the distance is, the larger the angle is [see Figure 3]. Another reason is that they can observe in other places and compare the data if the weather in an area is bad and they encounter a cloudy day when observing. The method of calculating [the Sun-Earth distance] has been briefly discussed in the 15<sup>th</sup> [October 1873] issue. And now three French astronomers and six American astronomers have arrived in the capital, including three who will take charge of the photography. Because the transit of Venus is difficult to record accurately while making visual observations, using photography can help astronomers to record the whole transit, which will be convenient for future use. The application of photography has had a profound influence on the development of astronomy. American astronomer James Craig Watson has described the transit in detail. Here is a brief translation of his opinions:

The transit of Venus will happen on the 11th month of the Chinese lunisolar calendar.

It will begin at 9:32. Mid-transit will be at 12:01. It will end at 2:18. When Venus enters the Sun, the angle will be 51° northeast. When it exits the Sun, the angle will be 22° northwest.

Because Venus will pass in front of the Sun, it will be seen that the radius of Venus is one thirtieth the radius of the Sun. (Seen from the Earth, Venus is like a bean. When it passes across the face of the Sun, people can use sunglasses or stained glass to observe it. These devices will be described later.) (Martin, 1874f; our translation).

People who were curious about the phenomenon would be able to observe it on the day because of the detailed description provided by Professor Watson. He predicted that the transit of Venus would begin at 9:32 and end at 14:18 on 9 December 1874. The whole event would take 4 hours and 46 minutes. Watson also identified the locations where Venus would enter and exit the Sun, the route it would take in crossing the disk of the Sun, and its size relative to the Sun.

The transit of Venus was not only reported in the *Peking Magazine*, but it also was covered by the newspaper *Shen Bao*,<sup>2</sup> which had a large circulation. Before it took place, there were a few reports on the transit published in this newspaper (*Shen Bao*, 1874(a); 1874(b); 1874(d)). The interesting thing was that the *Shen Bao* used the opportunity to publish advertisements for telescopes one month before the transit (e.g. see *Shen Bao*, 1874(c)). Interest in the transit among common people really stimulated business.

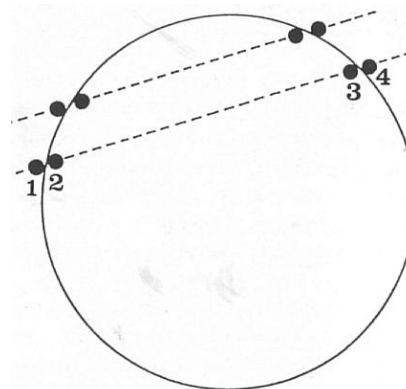


Figure 3: Ingress contacts (1 and 2) and egress contacts (3 and 4) during a transit of Venus. The two transects show the different paths of Venus across the Sun's disk viewed from observing stations that are widely separated in latitude (but for the purposes of illustration we have inserted considerable vertical exaggeration) (courtesy: Wayne Orchiston).

On 8 December, the day before the transit, the *Shen Bao* published the specific time schedule for the event in Shanghai on the first page:

At 9:50:30, Venus will touch the edge of the Sun. At 12:14:6, Venus will reach the center of the Sun. At 14:10:30, Venus will first touch the inside edge of the Sun. At 14:37:48, Venus will leave the Sun altogether [and the transit will be over—see Figure 3]<sup>3</sup> ... the times mentioned above are quoted from the appendix in the *Wan Guo gong bao*. (*Shen Bao*, 1874(d); our translation).

The report explained that the information was from the *Wan guo gong bao*,<sup>4</sup> in Shanghai. Furthermore, the *Universal Circulation Herald*<sup>5</sup> in Hong Kong also covered the news. Due to the large circulation of the *Shen bao*, the *Wan guo gong bao* and the *Universal Circulating Herald* at that time, the transit of Venus should have been popular with the public.



An official of the Qing Dynasty also provided a description of the phenomenon. However, it differed significantly from the account provided by the Western people. It predicted that the event would happen at night, which was obviously incorrect. It turned out that some people wrote to the *Peking Magazine* to ask about the true situation, and the *Peking Magazine* was forced to deny the accuracy of the official account published in the 27<sup>th</sup> issue and iterated that the data in the 25<sup>th</sup> issue (Martin, 1874f) were correct:

A reader asked about the difference between the accounts from Western countries and the official version. The letter said that according to our magazine, Western countries predicted the transit of Venus would occur on the first day of the 11th month of the Chinese lunisolar calendar and it would begin at 9:32 and end at 14:18. However, the official astrological almanac *Qizheng* said that it would happen on the second day of the 11th month of the Chinese lunisolar Calendar and would begin at 0:14. Accordingly, the phenomenon will happen at night and can only be observed from the Western Hemisphere. So why are Western scientists so eager to come to the Eastern Hemisphere? Astronomers from five countries, namely Britain, the United States, France, Germany and Russia have come here, and those from France, the United States and Russia have even come to the capital. It can't be a coincidence that they all came here at the same time. It seems like there's a mistake in the official account. We only have to wait for a few days to find out the truth. If the weather is good on that day, we will see it right away. If it is a cloudy day, we only will be able to see it in some other places. And after the transit, we can make the previous calculations of the distance between the Sun and other planets more accurately. The method of calculation has been introduced at the 15<sup>th</sup> issue. It seems that there are differences in the predicted dates of the transit, that we say the 30th of the 10th month rather than the 1st of the 11th month but this is because Western astronomers start the date from noon while the Chinese lunar calendar calculates the date from midnight. So, there is no difference. And the time schedule of the transit of Venus has been published in the 25<sup>th</sup> issue. (Martin, 1874c; our translation).

The officials did not ignore the transit but we have yet to find any of their accounts or records. However, there is some indirect evidence that indicates that they did carry out observations. For example, on page 22 in Volume 11 in the local chronicles of Zhejiang Province there is a report that on the first day of the 11th month of the Chinese lunar calendar during the 13th year of the reign of the Emperor Tongzhi, there was a black spot on the Sun (Yan Zhenheng, 1879). That was 9 December 1874, the exact date of the transit, and because people lacked knowledge of the transit Venus was referred to as a 'black spot'.

### 3 OBSERVATIONS OF THE TRANSIT

The accounts of the up-coming transit stimulated public interest, and detailed information on the planned observations was covered in the November 1874 issue of the *Peking Magazine* (Martin, 1874a; 1874c). In addition, a student named Zuo Binglong from Tongwen College, a foreign language school, wrote an informative article titled "The Record of the Observation" which introduced the equipment that he saw in Professor Watson's apartment:

It was said that the Western astronomical instruments were sophisticated. And I was so eager to see them for myself. Yesterday when I passed the apartment of James Craig Watson, I got the chance to see the equipment that they will use to observe the transit of Venus. I was so excited to see such a sophisticated instrument. I recorded the main features of the observing system immediately after I returned home and translated them into English. Then I presented this account to my supervisor Mr. William Alexander Parsons Martin. Mister [Martin] was impressed with the article and sent it to Mr. Watson, expecting me to translate it into Chinese. And now there must be a lot of newspapers that want to publish it. I can't describe the instruments very well because of their complexity. (Zuo, 1874).

Not long after the transit of Venus, the results of the observations made by the American, French and Russian parties were published in the December 1874 issue of the *Peking Magazine*:

On 9 December, Venus transited the Sun. Astronomers from the United States, France and Russia had readied their equipment early in the morning for the observation. At the time predicted, Venus appeared. Although Venus is about the same size as the Earth, it only looked like a little ball when seen from the Earth because of its great distance from us. When it entered the Sun, there were clouds in the sky. After 12:00, the clouds moved away and we could see it again. The transit began at 9:33 and ended at 14:17 which were quite in accordance with the prediction.<sup>6</sup> American and French astronomers also took photographs of the Sun. The Americans used glass plates and got more than ninety pictures. The French ... got tens of pictures, each of which accurately recorded the position of Venus on the Sun's disk ... Western countries paid a lot of money to come here to observe the transit of Venus and in the end they were successful. However, had they only observed from Peking and not at other places, because of clouds their observations would have been useless. If they were able to observe at other places, the distance between the Earth and the Sun could be calculated ... Successful observations were made at more than forty locations. Therefore, the data can be used to compute an accurate value for the distance. In about one year the results will be known to the public. The illustration [shown here in Figure 4] was drawn by James Craig

Watson.

We heard that the German astronomers observed the transit from Yantai. And the Japanese media reported that some Americans saw the transit from Nagasaki. In eight years time, the next transit of Venus will only be visible from America and some other countries. It is unknown whether China will send astronomers there to conduct observations. (Martin, 1874e; our translation).

In the meantime, the *Shen Bao* also reported observations made at various locations. According to the 12 December 1874 issue,

Shanghai received a telegram from Nagasaki yesterday. This said that it was a little foggy in Nagasaki although the weather was generally good enough to observe the transit. A telegram from Yokohama said that the weather there was perfect for the observations. And the weather in other places also was suitable.

Astronomers in Shanghai had prepared for the observation for so long. But because the day was foggy, they did not observe it as well as they wanted to. Fortunately, the fog faded away for a moment and the astronomers were able to take some photographs of the transit. The weather in Yantai was perfect, and the astronomers took advantage of this for their observations. (*Shen Bao*, 1874(e); our translation).

On 19 December 1874 the *Shen Bao* reported:

A message from Yokohama said that an astronomer used the telescope to observe the transit and the image was pretty clear. And it had been hypothesized that there was a “hot atmosphere” around the Sun and the observation this time really proved it ... Venus moves at 40,000 kilometers an hour. The rotation period of Venus is 23 hours and 21 minutes, which is 39 minutes less than that of the Earth. The new figures are more accurate than before due to the observations. (*Shen Bao*, 1874(f); our translation).

Public interest in the transit did not fade away quickly. One month after the transit, Watson delivered a lecture in Shanghai about the transit and its relation to the problems in astronomy, and this was reported in the 14 January 1875 issue of the *North China Herald*.<sup>7</sup> Watson displayed 3 of the 99 photographs of the transit taken in Peking, and diagrams to illustrate the subject in a popular manner. Notwithstanding unfavourable weather, an audience of nearly 200—including a large proportion of ladies—was present and received a rare intellectual treat.

Additional information was in the February 1875 issue of the *Peking Magazine*, including a report on the transit observations of the French astronomer Frégate Fleuriais written by the French Ambassador in Wuhan, F. Scherzer (1875).

Furthermore, news of the transit observations made in Japan was also covered in the same issue of the *Peking Magazine*:

In the middle of the observation, the sky was clear enough to take more than ten clear photographs. However, there were clouds in the sky at the beginning and the end so that the pictures taken in those periods were not clear. The Emperor of Japan heard that the transit of Venus was a rare phenomenon. He really admired the courage and efforts of the Western astronomers. Therefore, a telescope was placed in the Palace for the Emperor to use. The whole of the transit was visible. And there was an American and a Japanese astronomer in the Palace to explain the transit to the Emperor.

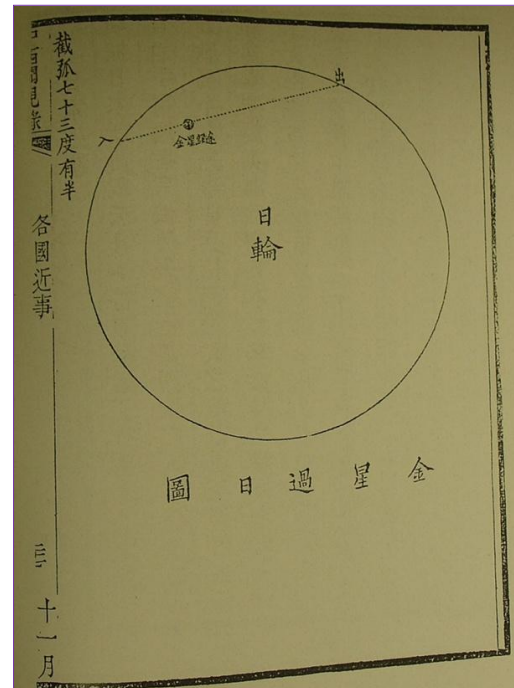


Figure 4: The drawing of the transit made by James Craig Watson (after Martin, 1874e).

One French astronomer [with the Chinese name Ransun] who was in Japan for the observation of the transit of Venus now lives in Nagasaki. He plans to observe the eclipse of the Sun in Siam in March.<sup>8</sup> Scientists are eager to discover more about the structure of the Sun which is normally too dazzling to observe ... However, the sky will be dark when the eclipse of the Sun occurs. Ransun plans to go to Siam because it is predicted that this total eclipse of the Sun can only be seen from Siam (Scherzer, 1875; our translation).

It is also important to mention that before the transit occurred, Professor Watson regularly used his telescope to observe the sky, and in the process he accidentally discovered a new asteroid. Because he made the discovery while in China, Watson invited Prince Gong to name it. News about this discovery was published in the 27<sup>th</sup> issue of the *Peking Magazine* (Martin, 1874a). Prince Gong approved the suggestion and he named the asteroid Ruihua, which means ‘lucky China’. This news was also included in the 20 December, 1874 issue of the *Shen Bao* (1874(g)).

#### 4 THE TRANSIT AND ASTROLOGY

In traditional Chinese astrology, the Sun represented the Emperor. If the Sun was interfered with by other celestial bodies, the reign of the Emperor would be challenged or the nation would be in danger. Therefore, the transit of a celestial body across the Sun was generally translated as inauspicious. During the late Qing Dynasty, although plenty of overseas scientific works had been translated into Chinese and basic knowledge had been circulated among the public, it was impossible for the authorities, who still used traditional astrology, to interpret these types of phenomena in a scientific way. So each report of an abnormal astronomical event was followed by an astrological interpretation.

The attitude of the non-official scholars was the opposite. Before the 1874 transit of Venus, the Editor of the *Peking Magazine*, William Martin, had predicted the superstitious reactions of the public, and so the magazine published a scientific article titled "Debate on Astrology" by Li Shanlan, a very famous Chinese mathematician in nineteenth century China, which demonstrated that ancient astrology was ridiculous:

The theory of astrology is a kind of cheating and has a bad effect on society. People who preached astrology would be sent to the guillotine in ancient China. So a man of insight should be careful and not be deceived by these people. (Li, 1873).

Supporting Li Shanlan was one of his colleagues, Gui Lin, who wrote an article "Sequel of the Debate on Astrology" which was published in the October 1873 issue of the *Peking Magazine* (Gui, 1873). This article used various examples to prove that astrology was harmful to the public.

However, the influence of the *Peking Magazine* was limited, and superstitions could hardly be changed in so short a time. Only a few days after the transit, the astrological explanation of the event was being circulated among the public. It was stated that Emperor Tongzhi's smallpox was related to the transit. And the following message was published on the *Shen Bao* (1874(h)):

The Emperor has been ill ... [He] got smallpox at the beginning of this month ... [and] has suffered from the illness for seven days. The doctor said that the Emperor will recover soon ...

Although the newspaper said that the Emperor's situation was not critical, he passed away on 12 January 1875, and rumors quickly circulated:

The news from Tianjin: the rumors said that people were intimidated by the illness of the Emperor. And the transit of Venus was the sign of this sickness ... (*Shen Bao*, 1875).

William Martin then wrote an article titled "Argument on Astrology" arguing against the ru-

mors, and this was published in the January 1875 (29<sup>th</sup>) issue of the *Peking Magazine*:

In ancient times, when language did not exist, people observed the sky and invented astrology. One star represented the Emperor. Other stars represented the officials. Their fates were determined by celestial phenomena. Western and Eastern cultures both agreed with this ... However, Western countries soon abandoned the ancient idea and believed in scientific explanations. People laughed at those who still believed in astrology. And two astronomical events have confused the public this year in China. The first was the comet that appeared in the north-western sky.<sup>9</sup> Rumors circulated because Japan began competing with China over Taiwan. People recognized the comet as a sign and did not understand that it had its orbit and showed up periodically. Besides, a comet is a universal phenomenon for all the countries around the world, not just China. How could the appearance of a comet be a sign for all international affairs? The second event was the transit of Venus which was recognized as a sign of the illness of the Emperor. People did not know that these transits had happened before. A transit of Venus was visible from China one hundred and five years ago, in the reign of Qianlong. At that time Qing China was enjoying prosperity, so nobody worried about this inauspicious omen. Two hundred and thirty-five years ago, astronomers in Western countries also saw a transit of Venus, but no evidence exists to show that any of the Emperors reacted to that event. Those in America will see the next transit in eight years time, but Western people do not express concern about the future. Therefore, using astrology to divine the future is ridiculous. If public opinion is misled by such absurd theories, society may descend into chaos. Compared with traditional astrology, Western learning seems more realistic and practical due to its calculated scientific approach. (Martin, 1875).

These kinds of articles were quite effective at that time. For example, an article, "After Reading the Argument of Astrology" by a reader, Yin Rui-chang from Tianjin, was published in the August 1875 issue of the *Peking Magazine* (Yin, 1875). The article criticized traditional astrology, which Yin viewed as absurd, and he supported the statements of Li Shanlan and William Martin. He also discussed in depth the historical reasons for the belief of Chinese officials in astrology.

Indeed, we can see the relationship between astronomical phenomena and the fate of an Empire from the official documents of the late Qing Dynasty. For instance, the teacher of the Emperor, Weng Tonghe, paid close attention to the appearance of Coggia's Comet. During that period, Weng observed the sky every night, and became worried about a sudden change in the Empire (Chen, 2006). We can understand his attitude towards astronomical phenomena as he represented the conservatives in China.



However, the attitude of a reformer, Chen Chi, was inexplicable. He mentioned the transit of Venus in a letter to his friends Wen Tingshi and Li Shengduo:

Though having a good command of calculation, I am convinced of astrology. Venus transited the Sun in the 13<sup>th</sup> year of the reign of Tongzhi, and then the Emperor died, which made me have increased faith in astrology. Westerners claim that there is no relationship between celestial phenomenon and the fortunes of a country because nothing particular happened as a result of the transit. (Chen, 1875).

Chen Chi was fond of Western literature and promoted Western culture, so it was surprising that he still stated that the transit of Venus and the death of Emperor Tongzhi were related.

## 5 DISCUSSION AND CONCLUDING REMARKS

From the various newspaper accounts cited above we know that the transit of Venus was not only significant scientific news, but also was an event that was considered relevant to the death of the Emperor.<sup>10</sup> Ten years later, the drawing reproduced here in Figure 5 appeared in the *Dian shi zhai hua bao*,<sup>11</sup> a magazine that was established in 1884. This drawing relates to observations of a transit of Venus made at Tongwen College. The

following is an English translation of the script that appears on this drawing:

It is said that mathematics is the basis of science in the West. By using calculus, astronomers predict astronomical phenomena and verify their predictions. Tian Wensheng (students majoring in astronomy) from Tongwen College predicted the transit of Venus would happen at 15 o'clock on the 8th day of the 10th month of the Chinese lunisolar calendar. So they set up an observatory and prepared instruments in the general administration office, and ministers of the office were invited to carry out the observations together with the astronomy teachers and the students. Whether this astronomical event had a direct correlation with the fortunes of the country aroused more heated debate than it deserves, but what was more important was to make the observations and provide a scientific interpretation.

From the date of the record it would appear that the transit of Venus mentioned in the *Dian shi zhai hua bao* occurred in 1882. However, the 1882 transit was not visible from China (see Sheehan and Westfall, 2004), so we can be certain that the record relates to the 1874 transit, but the script in the picture records that the transit began at 15 o'clock on the 8th day of the 10th month of the Chinese lunisolar calendar, whereas the 1874 transit began at 9:33 and ended at 14:17

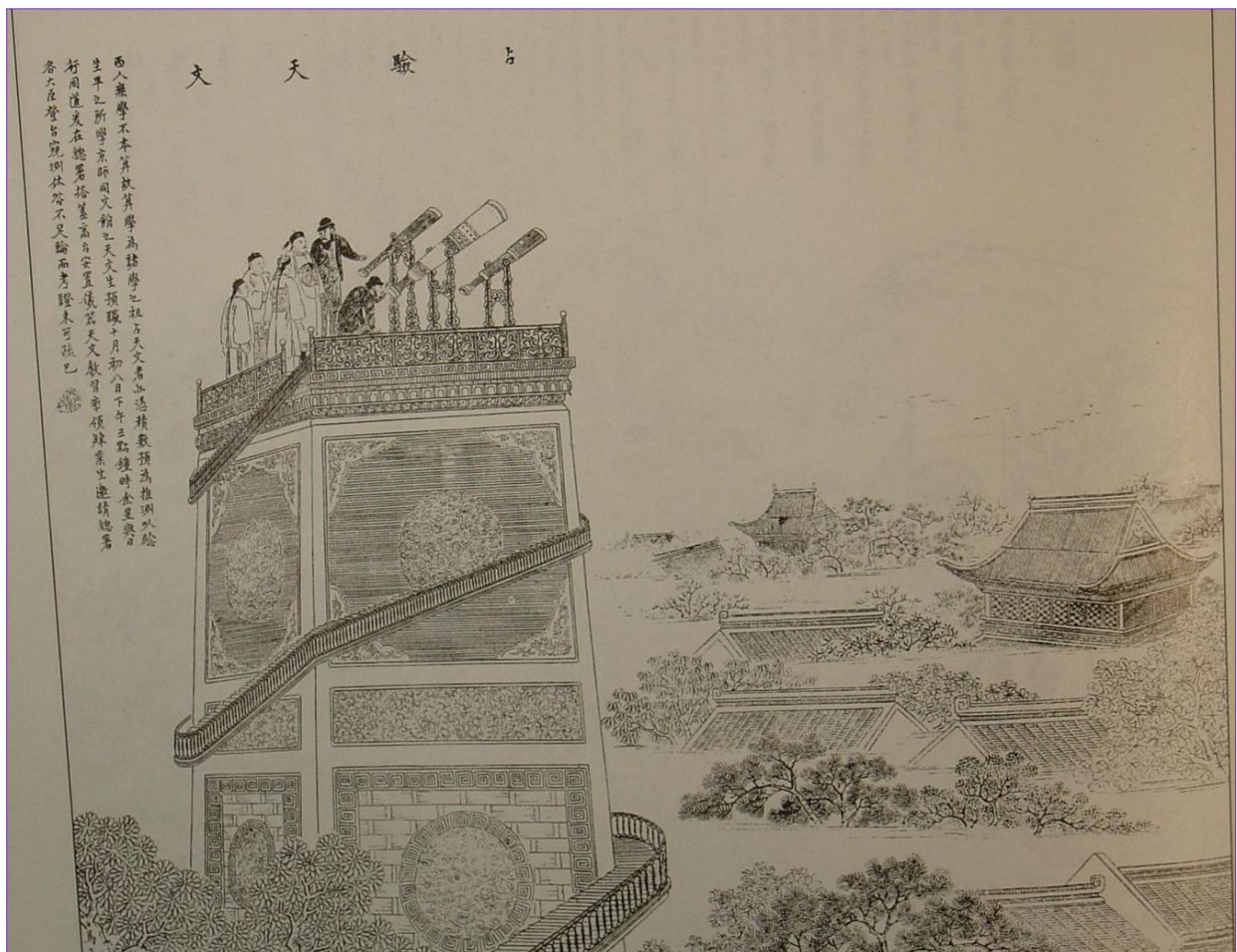


Figure 5: Observing the 1874 transit of Venus (after the *Dian shi zhai hua bao*, 1884).

on the first day of the 11th month of the Chinese lunisolar calendar. So the account in the *Dian shi zhai hua bao* is incorrect. But this record reflects people's memories of the 1874 transit after many years, and from this viewpoint we can see the significance of these phenomena to the Chinese people. This especially demonstrates that the efforts of William Alexander Parsons Martin and some Chinese intellectuals to try to eliminate traditional astrology was not futile. The Chinese public had begun to appreciate the scientific meaning of these kinds of astronomical events.

It is a pity that we did not find any reports of Chinese officials making observations of the 1882 transit of Venus, and it seems that some time still had to pass before Chinese astronomers would begin to participate actively in international astronomy.

## 6 NOTES

1. The *Peking Magazine*, a monthly journal that was established by William Alexander Parsons Martin and Joseph Edkins in August 1872, was devoted to Western and international news, but it also included articles on astronomy, geography and science in general (see Zhang, 1995).
2. The *Shen Bao*, formerly transliterated as the *Shun Pao* or the *Shen-pao*, and known in English as the *Shanghai News*, was a newspaper that was published in Shanghai from 30 April 1872 to 27 May 1949. The name is short for *Shenjiang Xinbao*, Shenjiang being a short form of Chunsheng jiang, the old name for the Huangpu River. This newspaper was founded by English businessman Ernest Major, and was one of the first modern Chinese newspapers. It played a pivotal role in the formation of public opinion in the late nineteenth century.
3. Astronomers recognize four distinct contacts that occur during a transit of Venus, and these are shown in Figure 3. There are two ingress contacts (1 and 2, in this Figure) and two egress contacts (3 and 4). Most critical in determining a value for the astronomical unit are the precise times of contacts 2 and 3. Observers widely spaced in latitude will see Venus cross the Sun on different (parallel) transects, as shown in Figure 3, and the angular separation of these transects is also critical in calculating the solar parallax and ultimately the astronomical unit.
4. The *Wan guo gong bao*, originally established as the *Church News* by the American Methodist missionary the Reverend Young John Allen of Georgia (Lin Lezhi), changed its name to *Wan Guo Gong Bao* (in English, *The Global Magazine or A Review of the Time*) with the 301st issue. Its subject matter ranged from discussions on the politics of Western nation-states to the virtues and advantages of Christianity.
5. The *Universal Circulating Herald* was established in Hong Kong on 4 February 1874 by Wang Tao, a famous political commentator of the time. The aim of this daily newspaper was to introduce early reformists' views.
6. In fact the start of the transit in Peking was just 1 minute later than predicted and the end just one minute earlier than predicted.
7. The *North China Herald* was also the gazette (official record) of the British Supreme Court for China and Japan, and the British Consulate. This newspaper was an influential force in Shanghai and throughout China.
8. The 6 April 1875 total solar eclipse was visible from Thailand (then referred to as Siam), and British and French expeditions led by Professor Arthur Schuster and Professor Jules Janssen respectively came to Thailand and successfully observed it (see Hutawarakorn-Kramer and Kramer, 2006; Launay, 2012). The presence of these eclipse expeditions was due to the enlightened views of King Rama V, who had a personal interest in astronomy, and he and other members of the Thai Royal Family also carried out systematic observations of this eclipse (see Soonthornthum, 2013). However, from an international perspective, this eclipse did not have the same importance as the 16 August 1868 total solar eclipse. Because of the introduction of spectroscopic observations, this earlier eclipse was a 'watershed event' in our understanding of prominences and of the solar corona (see Clerke, 1893; Orchiston et al., 2006). By good fortune, this total solar eclipse also was visible from Thailand (see Orchiston et al., 2013).
9. Comet C/1874 H1 (Coggia), popularly known as 'Coggia's Comet', was one of the Great Comets of the nineteenth century. It was a prominent naked eye object, and at its prime exhibited a spectacular head and tail whose changes helped to further our knowledge of cometary structure (see Guillemin, 1877).
10. These Chinese accounts of the 1874 transit of Venus are in marked contrast to the ways in which the 1874 and 1882 transits were depicted and promoted in most Western newspapers and magazines where the focus was very much on their scientific attributes and importance (see Cottam, 2012). For example, see Cottam et al., 2011 and 2012 for the ways in which these two transits were discussed in the *New York Times*.
11. The *Dian shi zhai hua bao*, an illustrated magazine, was established in 1884. It was attached to the *Shen Bao*, and was published every ten days. Every issue had 8 pages containing



recent news and associated pictures. In order to appeal to readers, some of the pictures and text tended to be exaggerated.

## 7 ACKNOWLEDGEMENTS

Our thanks go to Professor Wayne Orchiston who encouraged us to write this paper and then assisted us in revising it, and to Miss Yumeng Wang and Xinpei Liu who helped us finish the first English draft of this paper.

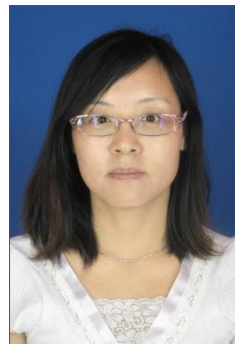
## 8 REFERENCES

- Chauvin, M., 2003. *Hōkūloa: The British 1874 Transit of Venus Expedition to Hawai'i*. Honolulu, Bishop Museum Press.
- Chen chi, 1875. Unpublished letter to Wen Ting-shi and Li Shengduo. Cited by Kong Xiangji, 2007. Discussion of Ronghong's promotion of American experience: taking the 1898 reform movement as a focus. *Social Science in Guangdong*, 1, 91-99 (in Chinese).
- Chen Yijie, 2006. *The Diary of Weng Tonghe, Volume 3*. Beijing, Zhonghua Shuju (In Chinese).
- Clerke, A.M., 1893. *A Popular History of Astronomy During the Nineteenth Century*. London, Adam and Charles Black.
- Comstock, G.C., 1895. *Biographical Memoir of James Craig Watson*. Washington, National Academy of Sciences (*Biographical Memoirs*, III, 43-57).
- Cottam, S., 2012. The Popularization of Astronomy in America Subsequent to the Events of the Transits of Venus of 1874 and 1882 and the Total Solar Eclipses of 1868, 1869 and 1878. Unpublished Ph.D. Thesis, Centre for Astronomy, James Cook University, Townsville, Australia.
- Cottam, S., Orchiston, W., and Stephenson, F.R., 2011. The 1874 transit of Venus and the popularisation of astronomy in the USA as reflected in *The New York Times*. In Orchiston, W., Nakamura, T., and Strom, R.G. (eds.). *Highlighting the History of Astronomy in the Asia-Pacific Region. Proceedings of the ICOA-6 Conference*. New York, Springer. Pp. 225-241.
- Cottam, S., Orchiston, W., and Stephenson, F.R., 2012. The 1882 transit of Venus and the popularisation of astronomy in the USA as reflected in *The New York Times*. *Journal of Astronomical History and Heritage*, 15, 183-199.
- Dick, S., Orchiston, W., and Love, T., 1998. Simon Newcomb, William Harkness and the nineteenth century American transit of Venus expeditions. *Journal for the History of Astronomy*, 29, 221-255.
- Duerbeck, H., 2007. De Photographen des Venusdurchgangs von 1874. *Acta Historica Astronomiae*, 33, 358-397.
- Gui Lin, 1873. Sequel to the debate on astrology. *Peking Magazine*, October, pages 6-8 (in Chinese).
- Guillemin, A., 1877. *The World of Comets*. London, Sampson Low, Marston, Searle and Rivington.
- Hutawarakorn-Kramer, B., and Kramer, M., 2006. The King Rama V total solar eclipse of 1875: Schuster's expedition to Siam. In Chen, K.-Y., Orchiston, W., Soonthornthum, B., and Strom, R. (eds.). *Proceedings of the Fifth International Conference on Oriental Astronomy*. Chiang Mai, Chiang Mai University. Pp. 19-22.
- Lankford, J., 1987. Photography and the 19th-century transits of Venus. *Technology and Culture*, 28, 648-657.
- Lauga, J., 2004. Les missions Françaises pour le passage de Vénus de 1874. *L'Astronomie*, 118, 296-305.
- Launay, F., 2012. *The Astronomer Jules Janssen: A Globetrotter of Celestial Physics*. New York, Springer.
- Li Shanlan, 1873. Debate on astrology. *Peking Magazine*, July, page 3 (in Chinese).
- Martin, W.A.P., 1873. Transit of Venus. *Peking Magazine*, October, pages 1-4 (in Chinese).
- Martin, W.A.P., 1874a. A new star observed. *Peking Magazine*, November, page 49 (in Chinese).
- Martin, W.A.P., 1874b. Another item of news from America. *Peking Magazine*, July, page 25 (in Chinese).
- Martin, W.A.P., 1874c. Answer to the question of the time of the transit of Venus. *Peking Magazine*, November, page 50 (in Chinese).
- Martin, W.A.P., 1874d. News from France – overseas observations of the transit of Venus. *Peking Magazine*, April, page 22 (in Chinese).
- Martin, W.A.P., 1874e. News from Kyoto – observation of the transit of Venus. *Peking Magazine*, December, page 55 (in Chinese).
- Martin, W.A.P., 1874f. Sequel to the transit of Venus. *Peking Magazine*, September, pages 11-12 (in Chinese).
- Martin, W.A.P., 1875. Argument on astrology. *Peking Magazine*, January, pages 1-2 (in Chinese).
- North China Herald*, 14 January 1875, page 23 (in Chinese).
- Orchiston, W., 2004. The nineteenth century transits of Venus: an Australian and New Zealand overview. *Journal of Astronomical Data*, 10(7), 219-308.
- Orchiston, W., Soonthornthum, B., and Komonjinda, S., 2013. French observations of the 18 August 1868 total solar eclipse from Wah-Koa, Thailand. In Nakamura, T., and Orchiston, W. (eds.). *The Development of Astronomy and Emergence of Astrophysics in Asia*. New York, Springer (in press).
- Orchiston, W., Chen, K.-Y., Lee, E.-H., and Ahn, Y.-S., 2006. British observations of the 1868 total solar eclipse from Guntoor, India. In Chen,

- K.-Y., Orchiston, W., Soonthornthum, B., and Strom, R. (eds.). *Proceedings of the Fifth International Conference on Oriental Astronomy*. Chiang Mai, Chiang Mai University. Pp. 23-34.
- Pigatto, L., and Zanini, V., 2001. Spectroscopic observations of the 1874 transit of Venus: the Italian party at Muddapur, eastern India. *Journal of Astronomical History and Heritage*, 4, 43-58.
- Proctor, R., 1874. *Transit of Venus: A Popular Account of Past and Coming Transits*. London, Longmans, Green
- Ratcliff, J., 2008. *The Transit of Venus Enterprise in Victorian Britain*. Pickering and Chatto.
- Scherzer, F., 1875. A brief description of the transit of Venus observations by French astronomers. *Peking Magazine*, February, page 26 (In Chinese).
- Sheehan, W., and Westfall, J., 2004. *The Transits of Venus*. New York, Prometheus Books.
- Shen Bao*, 30 July 1874(a), page 1 (in Chinese).
- Shen Bao*, 3 September 1874(b), page 1 (in Chinese).
- Shen Bao*, 18 November 1874(c), page 3 (in Chinese).
- Shen Bao*, 8 December 1874(d), page 1 (in Chinese).
- Shen Bao*, 12 December 1874(e), page 1 (in Chinese).
- Shen Bao*, 19 December 1874(f), page 1 (in Chinese).
- Shen Bao*, 20 December 1874(g), page 1 (in Chinese).
- Shen Bao*, 28 December 1874(h), page 1 (in Chinese).
- Shen Bao*, 7 February 1875, page 1 (in Chinese).
- Soonthornthum, B., 2013. The development of astronomy and emergence of astrophysics in Thailand. In Nakamura, T., and Orchiston, W. (eds.). *The Development of Astronomy and Emergence of Astrophysics in Asia*. New York, Springer (in press).
- Woolf, H., 1959. *The Transits of Venus: A Study of Eighteenth Century Science*. Princeton, Princeton University Press.
- Yan Zhenheng, 1879. *Local Chronicles of Shimen County, Volume 11*. Shimen, Government of Shimen County (in Chinese).
- Yiu Ruichang, 1875. After reading the article on astrology. *Peking Magazine*, August, page 20 (in Chinese).
- Zhang Jian, 1995. A brief introduction of the *Peking Magazine*: evaluating its influence on the research of western Science and technology. *Journal of Fudan University (Social Science)*, 4, 57-62 (in Chinese).
- Zuo Binglong, 1874. A brief description of the observation site. *Peking Magazine*, November, pages 14-16 (in Chinese).



Dr Lingfeng Lu is an Associate Professor of History of Science at the University of Science and Technology of China in Hefei, but for much of 2013 is a Visiting Professor at The Cluster of Excellence "Asia and Europe in a Global Context: The Dynamics of Transculturality" at Heidelberg University in Germany. His primary interest is in European astronomy in China and the history of Chinese astronomical observations.



Dr Huifang Li is a Post-doctoral Fellow in History of Science at the University of Science and Technology of China in Hefei. She received her Ph.D. in the history of science from Shanxi University (Taiyuan, China). Her main research field is astronomy in modern China.