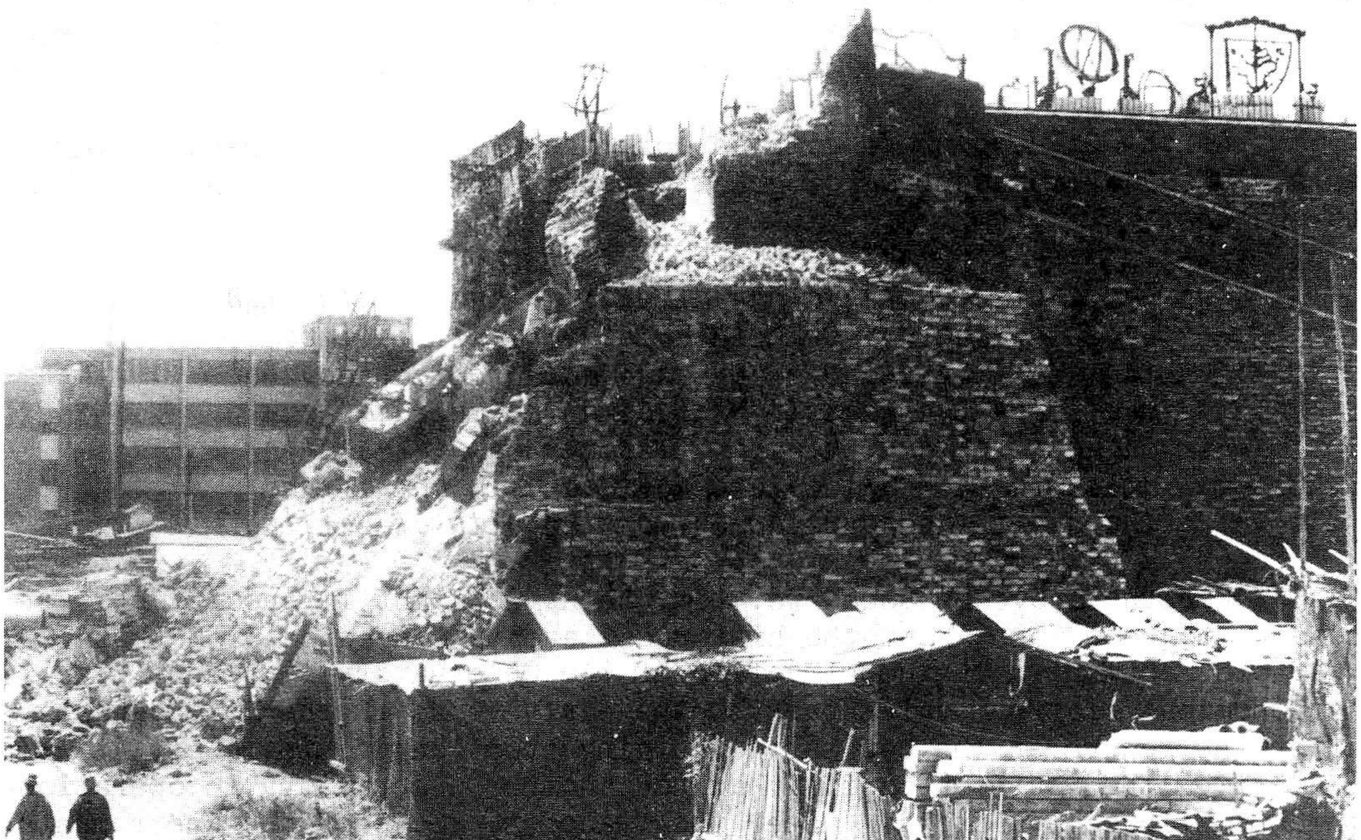
AN INTERNATIONAL LINK THROUGH THE SKIES

by Angelo S. Lazzarotto



THE ASTRONOMICAL OBSERVATORY'S PLATFORM
PARTLY COLLAPSED AFTER A RAIN STORM

The Guang Xiang Tai (觀象台), Beijing's ancient astronomical observatory, was reopened to the public on April 1st of this year. It had been closed for almost 20 years. During August of 1979, the eastern wall had collapsed. The wall is made of brick and rises to a height of 15 meters. While some blamed the collapse on the lowering of the water table in the general area and the earthquake of 1976 which weakened its foundation, a report issued shortly after the collapse attributed it to years of neglect that had allowed the Observatory to 'fall into disrepair'. The recent renovation has taken, with some interruptions, three years and has cost the government more than one million yuan. An extra two million yuan was also allocated to the Beijing underground rail system to alter its route in order to protect the site.[1]

Beijing Observatory has, perhaps, the longest recorded history of uninterrupted service to the science of astronomy. It is 200 years older than Greenwich Observatory and ceased to function only in 1929 when more modern facilities were constructed in another part of the city.

As the Chinese press pointed out, there are several reasons why this historical monument is of great interest not only to China but also to the West.

> *The ancient Observatory attests to the fairly high level of ancient Chinese astronomy. It is important for the study of China's astronomical development, for the part it played in the cultural exchanges between China and Western countries, the dissemination of Western religions in China, and the growth and development of the city of Beijing.*[2]

For the above reasons, we, too, think it might interest our readers to know more about the historical events connected with this 540 year-old monument. The construction of the Observatory's present astronomical platform dates back to the early years of the Ming dynasty, after the return of the capital to Beijing from Nanjing in 1406. At that time, the Southern Capital had had another Observatory in operation which continued to function after the transfer. Some of the instruments used in the old Nanjing Observatory had been fashioned during the Song and Yuan dynasties (960-1369). Bronze replicas of the armillary sphere, which dated back to the Song, and an abridged armillary with a sundial from the Yuan period, were cast in Beijing in 1437. Thus it is that Beijing Observatory, built by order of the Ming Emperor, links contemporary research with the great scientific achievements of 700 years ago.

When, in 1280, the Mongol Emperor Khubilai Khan established his capital in what afterwards became the inner part of the city of Beijing, the great Chinese scholar Guo Shoujing (郭守鏡) was appointed deputy astronomer of the court and commissioned to construct an observatory. Although the exact site of the original structure has not yet been identified, ancient documents indicate it to have been in the south-eastern corner of the defence perimeter of the city which is near the site of the present observatory. The main avenue crossing the capital today, Chang Anjie, still follows a line marked by the southern wall of the Mongol capital.[3]

The 13th century Observatory was equipped with some of the most advanced astronomical instruments at use in the world at the time, designed and executed largely by Guo Shoujing and his colleagues. It is believed that some of the instruments had already been in use in Kai-feng (開封), the capital city of the Northern Song. The 18th century French missionary Antoine Gaubil, who wrote several treatises on Chinese astronomy which were published in Europe, describes Guo Shoujing as "a man of extraordinary genius and work".[4]

Under the Yuan Emperors, the science of astronomy had reached remarkable levels in China. The Chinese theory of heavenly bodies floating in infinite space was far nearer reality than that of the Ptolemaic-Aristotelian concept of a geocentric universe consisting of solid domelike spheres, which prevailed at the end of the Middle Ages in Europe.[5] Early and frequent contact with the Arab world had led to the introduction of Arabic arithmetic. Arabic science continued to make out-standing contributions during the Ming Dynasty (1368-1644). A number of Arabian astronomers working with Chinese scholars in the Imperial Bureau of Astronomy had translated hundreds of Arabic manuscripts into Chinese.

In 1385, 1470 and again in 1477, the Moslem astronomers made proposals to the Ming Emperors for the reformation of the Chinese calendar (with the passing years, some errors had become evident, parti-cularly in calculating solar and lunar eclipses.) What made the science of astronomy most relevant to Chinese life was the lunar calendar. According to Chinese tradition, arranging the calendar is a privilege of the Emperor, one of the most evident signs of his power to put the world in order. By accepting their calendar from China's Emperor, the tri-butary countries show their allegiance. The making of calendars by private persons was, therefore, an attempt to usurp the imperial prerogative.... The founder of the Ming Dynasty issued a law at the end of the XIV century, forbidding private citizens from studying celestial phenomena and building astronomic instruments.[6]

This aspect of Chinese life greatly impressed Matteo Ricci, when he entered China in 1583. On his journey to Nanjing in 1595 he wrote of the excellently designed and beautifully constructed astronomical instruments that he saw in the observatory there. He thought them to be about 250 years old and inspired by European models. In fact, he was admiring the already mentioned masterpieces constructed 350 years earlier by Guo Shoujing. A few years later, Ricci was even more surprised to find their exact replicas in the observatory in Beijing.

In May of 1605, Ricci submitted to his superiors in Rome a request that he considered ".....of great importance for China". He asked that one or two European astronomers be sent to Beijing. "With their help", Ricci wrote, "we should be able to translate our tables into Chinese.... and thus undertake the task of correcting the calendar".[7] Only a few years earlier, the Western world had gone through its own unprecedented calendar reform. For 16 centuries the West had followed the Julian calendar, introduced by Julius Caesar in the year 46 B.C. In October of 1582, Pope Gregory XIII, to realign the Julian calendar with the findings of contemporary astronomy, eliminated ten calendar days at one stroke: October 4, 1582 was followed immediately by October 15, 1582. All the nations of the West have since followed the new Gregorian Calendar. After the proclamation of the Republic in 1911, the Gregorian Calendar was also adopted by China. An international conference of astronomers and other scientists was held in Rome last year to commemorate the 400th anniversary of the introduction of the Gregorian Calendar and to study new possibilities for changes. Proposed new calendars seek to align the annual orbit of the earth around the sun into a fixed chart that would be standard and permanent, taking into account the suggestions of the United Nations as well as those of the great world religions which have a vital interest in the question.[8]

When Ricci and his Jesuit confreres reached China, Europe was about to enter into a new era of scientific discovery. A famous "historical incident" which affected the scientific and cultural world in the West about that time, was the polemic centered around the discoveries of Galileo and the acceptance of the Copernican view of the universe. Although some Jesuits were convinced Copernicans, others were not, and it must be assumed that the subsequent trial of Galileo influenced many of them. "In general, the Jesuits brought with them some of the limitations and errors of the Ptolemaic-Aristotelian world view".[9]

Stressing this aspect, some Chinese historians have been very harsh in judging the overall Jesuit contribution to scientific progress in imperial China. Professor Bai Shouyi and his colleagues recently published a one volume history of China stating that ".....it is unthinkable that members (of the Society of Jesus) could bring modern science to China." With reference to astronomy, these scholars add: "They (the Jesuits) maintained that the change in the movements of stars and planets affects the fortunes or misfortunes of men".[10] However, Joseph Needham, in his masterly work on the history of the natural sciences in China, gives a more balanced account of the scientific exchanges between East and West brought about by the efforts of the Jesuit missionaries: "The part played by the Jesuits in Chinese astronomy has.....many links with the Asian Astronomy of former centuries, and.....much to teach us about the mutual impact of Chinese and Western thought".[11] Then, referring to several specific scientific ideas which were at the root of this exchange, Needham indicates that the positive contributions of the missionaries clearly outweigh their limitations and errors.

The 17th century was marked by the decline of the Ming and the rise of the Manchus. Astronomical research was at a low ebb and the imperial calendar's shortcomings became evident when several eclipses were wrongly predicted. In 1606, in answer to pressing requests sent by Ricci, Sabbatino De Ursis, an Italian well equipped in astronomy, arrived. Soon after Ricci's death in 1610, an imperial decree asked the foreign missionaries to present proposals for the reform of the Chinese calendar and to translate European scientific books into Chinese. De Ursis began working with the great Xu Guangqi (徐光啓) and other Chinese scholars. The work was interrupted in 1616 when a wave of opposition to the foreign missionaries reached the capital from Nanjing. In 1629, however, the task of calendar reform was again entrusted to the Jesuits. De Ursis had already died at the age of 45. The Swiss priest Jean Terrenz took over the responsibility, but he, too, died the following year.[12]

The German Jesuit Adam Schall von Bell and the Italian Giacomo Rho were then assigned to continue to work with Xu Guangqi on the reform of the calendar. Among the outstanding services rendered by Xu Guangqi to his country, his contribution to the reorganization of the calendrical Bureau of Beijing was his greatest and it was to be his last. (Xu had also founded an academy for the training of young Christian specialists in mathematics and astronomy.) Working quietly and intensely the missionaries were able to complete several translations of Western science books, which were then submitted by Xu to the Emperor in 1631 and in 1632. Altogether 72 manuscripts and one table of fixed stars were translated.[13]

After the sudden death of Rho in 1638, the Emperor presented the missionaries with a pai pien, a four-character inscription chosen by himself -- Ch'in-pao t'ien-hsueh ("Imperial praise for celestial doctrine"). This inscription was recorded in the imperial gazette, and it became known throughout the country. The expression could be interpreted as an homage to the religion of the missionaries or praise for their astronomical competence.[14]

Shortly after the Ming Dynasty was overthrown by the Manchus in 1644, the young Shun Che Emperor confirmed Adam Schall in his task of reforming the imperial calendar. He also appointed him President of the Bureau of Astronomy.[15] After Shun Che's death, however, Yang Kuang-hsien led other rival astronomers in an attack against him which resulted in 1664 in Schall's condemnation and imprisonment. Schall died in China in 1669. When the Kangxi Emperor came of age and took over the reins of power from his regents, he made Schall's assistant, the Belgian Jesuit Ferdinand Verbiest, Director of the Observatory. This appointment was made in 1669 only after the Emperor had subjected the Jesuit to extensive tests in the science of mathematics.

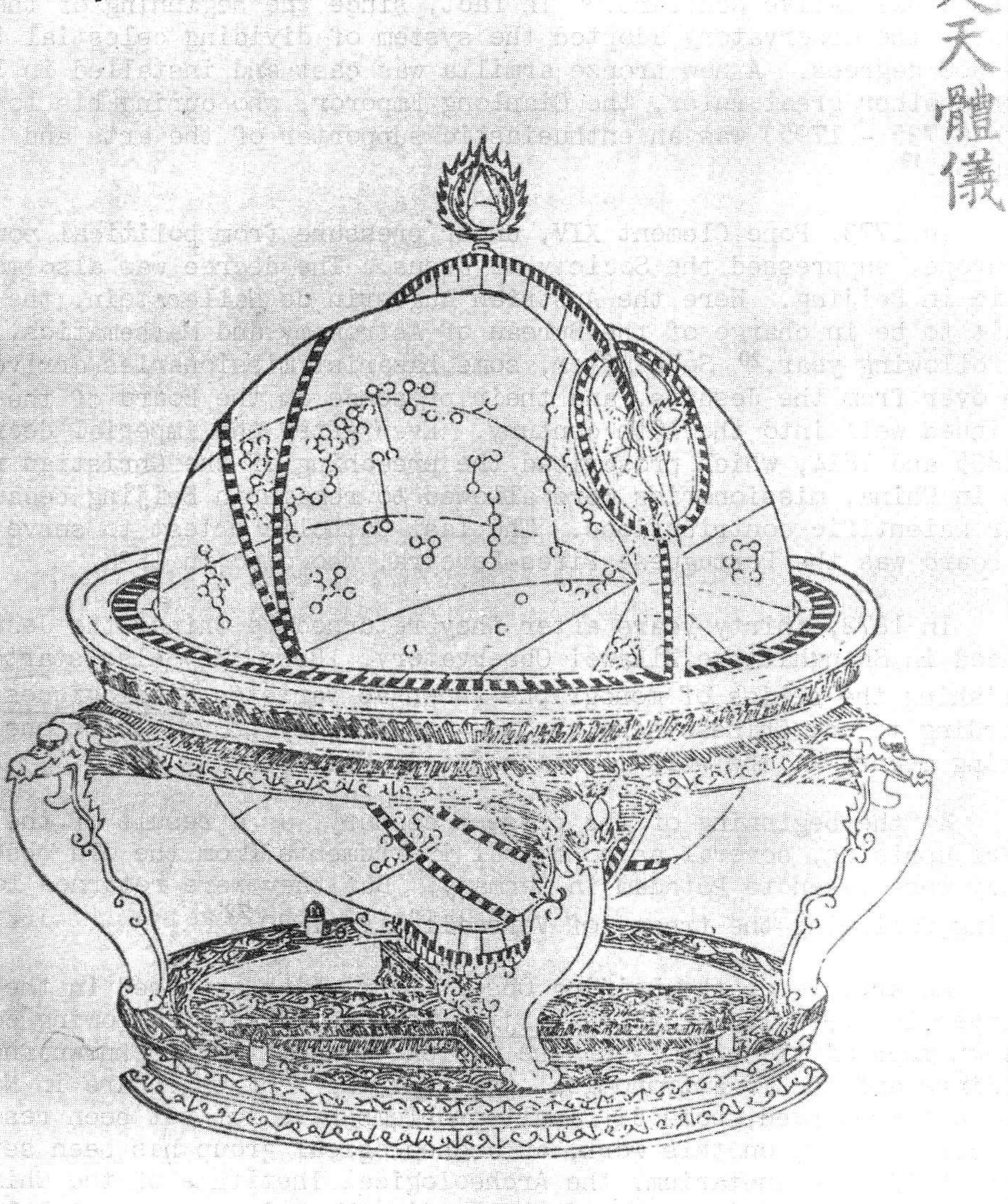
Verbiest was given the task of making new astronomical instruments, to begin refitting the Beijing Observatory. The instruments from the Yuan and Ming eras were taken down from the astronomical platform, which was situated on the eastern wall of the city and a new set installed in their place.

A drawing made by Verbiest himself gives us a good idea of how the observatory was arranged in the second half of the 17th century. Needham gives a list of instruments that were built by the Jesuits and others at the time.[16]

In 1673, the 12th year of the reign of the Kangxi Emperor, six large, bronze astronomical instruments, similar to ones used in Western observatories were added by the Belgian missionary. Verbiest wrote many treatises on astronomy and other sciences as well as on religion. Upon his death in 1688, he was given a state funeral by Emperor Kangxi and was buried next to Ricci and Schall. Their tombs are honored even to the present day. He was succeeded in the office of Director of the Board of Mathematics by the Italian Jesuit Philip M. Grimaldi and the Portuguese Thomas Pereyra. The Jesuit missionaries were to remain in charge of the Bureau of Astronomy and Mathematics for another century.

In 1705 the eastern side of the Beijing observatory was enlarged about five metres to install a theodolite, decorated with patterns after

Celestial Globe made for the Beijing Observatory in 1673 by Ferdinand Verbiest.



the style of the period of King Louis XIV of France.[17] Writing in 1710 about the progress of scientific research in China, Dominic Parrenin expressed the fear that many innovations introduced in the field of astronomy by order of Emperor Kangxi (1662 - 1722), might be rejected by future conservative scholars.[18] In fact, since the beginning of the Qing Dynasty, the observatory adopted the system of dividing celestial tables into 360 degrees. A new bronze armilla was cast and installed in 1744 under another great ruler, the Qianlong Emperor, who during his long reign (1735 - 1795) was an enthusiastic supporter of the arts and sciences.[19]

In 1773, Pope Clement XIV, under pressure from political powers in Europe, suppressed the Society of Jesus. The decree was also made public in Beijing. Here the Austrian Augustin de Hallerstein, the last Jesuit to be in charge of the Bureau of Astronomy and Mathematics, died the following year.[20] Soon after, some Lazarist missionaries arrived to take over from the Jesuits, and their presence on the Board of the Bureau continued well into the 19th century. Even after the imperial decrees of 1805 and 1814, which proscribed the preaching of the Christian religion in China, missionaries were allowed to remain in Beijing because of their scientific contributions. The last Catholic priest to serve on the Board was the Portuguese Pires-Pereira, who died in 1838.

In 1872, thirty years after they returned to China, the Jesuits founded in Shanghai the Zikawei Observatory. Here they also started publishing the series of monographs known as Variétés Sinologiques. According to one Chinese scholar, the observatory proved to be one of lasting memory to the work of Catholics in China.[21]

At the beginning of the present century, as a result of the Boxers uprising, several astronomical instruments from the old observatory were taken to Potsdam in Germany. But they were returned to Beijing following the treaty of Versailles in 1920.[22]

An article on the Beijing Observatory which appeared in the November 19, 1979 issue of the Beijing Review made the following comment: "Though much of the history of the ancient observatory is known and its buildings and the 15 astronomical instruments (7 of which are in Nanjing) have been preserved, some difficult problems have not yet been resolved. In order to carry on this work, an archeological group has been set up by the Beijing Planetarium, the Archeological Institute of the Chinese Academy of Social Sciences, and the Beijing Municipal Cultural Relic Bureau."

Catholic scholars and other foreign friends of China share a lively interest in the results of this historical research. It is to be hoped that the great wealth of documents which are still buried in Western archives may also be fully utilized.

The present "open door policy" of the Chinese authorities and the keen interest of Chinese researchers to foster international links and cooperation seem to be sufficient grounds for hoping that a combined effort in this field might be possible. This would be fully in line with the scholarly cooperation that had characterized the past, when for three centuries so many European Catholic missionaries worked side by side with Chinese scientists in the Beijing Observatory.

FOOTNOTES:

1. Beijing Review, 9 Nov. 1979; XINHUA News Agency, 1 April 1983; China Daily, 2 April 1983.

2. BR, 9 Nov. 1979.

3. The recently restored Observatory is clearly visible on the right hand side of Chang Anjie Avenue when travelling east, at a point facing the Academy of Social Sciences, near the Friendship Store.

4. J. NEEDHAM, Science and Civilization in China, Cambridge (Mass.) 1959, III, p. 381. For the history of Chinese astronomy cf. ib., p. 171. See also the voluminous collection: A. GAUBIL, Correspondance de Pékin 1722-1759, R. Simon Ed., Geneve 1970, pp. 1001.

5. G.H. DUNNE, Generation of Giants - The Story of the Jesuits in China in the last Decades of the Ming Dinasty, Notre Dame, 1962, p. 220, s.

6. J. GERNET, Chine et Christianisme - Action et Réaction, Paris 1982, p. 86 s.

7. DUNNE, op. cit., p. 210 s.

8. Pope John Paul II, addressing the conference of astronomers stressed that the Catholic Church backs all efforts which link the life of the Church to scientific research. "It is necessary for this relationship between faith and science to be constantly strengthened and

for any past historical incidents which may be justly interpreted as being harmful to that relationship to be reviewed by all parties as an opportunity for reform and for pursuing more harmonious communication." Sunday Examiner, 17 Sept., 1982.

9. DUNNE, op. cit., p. 69.

10. BAI SHOUYI (Ed.), An Outline History of China, Beijing 1982, p. 428.

11. NEEDHAM, op. cit., p. 437.

12. Terrenz, a highly competent mathematician and astronomer, joined the Jesuits at the age of 35 and left for China at 42 in 1616 where he died in 1630: L. PFISTER, Notices Biographiques et Bibliographiques des Jésuites de l'Ancienne Mission de Chine, I, Shanghai 1932, 153.

13. DUNNE, op. cit., 222. This year is the 350th anniversary of the death of Xu Guangqi, who died on 8 Nov. 1633.

14. G. Rho was 45. Only a few of the foreign priests and scholars who volunteered to leave their countries for service in the Middle Kingdom reached old age. DUNNE, op. cit., 310.

15. DUNNE, op cit., pp. 325, 336, PFISTER, op. cit., p. 167. Schall had repeatedly refused the honorific title. Besides his concern for the simplicity of religious life, he was confronted with opposition from some confrères for cooperating in the calendar work. Because propitious days for certain public acts at the court were determined in accordance with the calendar, his work was seen as cooperation in superstitious practices. The question was referred to Rome and a ruling by a commission of 5 theologians in 1655 cleared him. New debates developed in 1660 and again in 1662, prompting Fr. Schall to write a booklet of explanation. In 1664 a new commission of theologians in Rome finally declared that Schall and his colleagues were clear of any wrong doing.

16. NEEDHAM, op. cit., p. 451 s.

17. BR, 9 Nov. 1979.

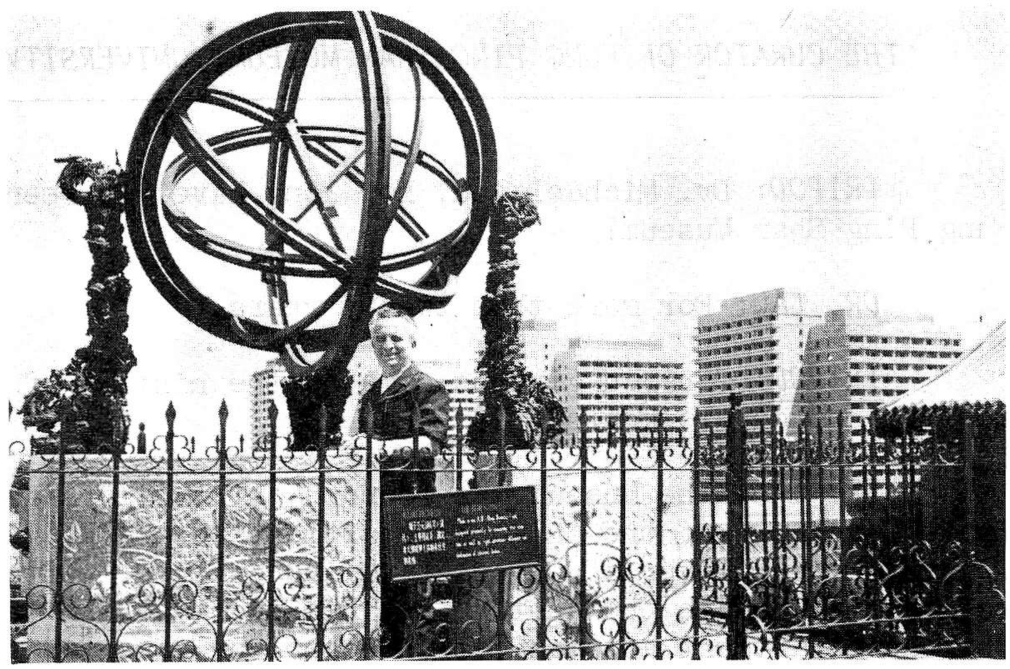
18. Lettres Edifiantes et Curieuses de Chine par les Missionnaires Jésuites 1702-1776, Paris 1979, p. 360.

19. BR, 9 Nov. 1979.

20. In a letter of Sept. 24, 1766 de Hallerstein wrote: "Arts may be appreciated at the (imperial) court and are useful, but astronomy and mathematics are the indispensable instrument, without which nothing could be done here." PFISTER, *op. cit.*, p. 174, n.1.

21. J. CH'EN, *China and the West*, London 1979, p. 94.

22. A list of these instruments can be found in S. COULING, *The Encyclopaedia Sinica*, Shanghai 1917, p. 403.



The author visited the renovated Beijing Observatory in July 1983