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THE IMPACT OF THE EIGHTEENTH CENTURY JESUIT ASTRONOMERS ON THE ASTRONOMY OF INDIA AND CHINA

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Within a span of 60 years (1670-1730) a number of great observatories were erected in China and India, and a systematic programme of observing the heavens carried out under royal patronage. In these activities, along with the local scholars, several eminent Jesuit astronomers from Europe participated. The article examines the impact of these European astronomers, who brought the knowledge of Europe to the East, on the astronomical traditions of the two countries.

The telescope was adopted by the royal astronomers of China and became a regular tool in their hands for their astronomical observations. The astronomers of India, on the other hand, including Maharaja Sawai Jai Singh, the founder of the observatories at Delhi and elsewhere, apparently failed to incorporate it into their own instrumentation.

Strangely, the Jesuits did not introduce the Copernican revolution to either country, though the revolution had a solid backing of the brillant discoveries of Kepler, Galileo and Newton. They continued to advance and defend the discredited Ptolemic system of the universe, in tune with their brethren in Europe. The countries, as a result, remained in the dark about the Copernican revolution until the advent of British in India, and Protestant missionaries in China.

The article scrutinizes the religious and cultural background of the Jesuits and draws the conclusion that the theological beliefs of the Jesuits prevented them from being the pioneers of Copernican revolution in their host countries.

INTRODUCTION

The closing decades of the 17th century and the early ones of the 18th, witnessed a great surge of astronomical activity in the countries of the East. In China the old observatory of Peking was renovated and, in India and Japan new observatories built. At these observatories, astronomers carried out systematic observations of the sky. They prepared astronomical tables and translated or wrote texts and treatises on the subject. The period is important from a different point of view, as it is when the post renaissance science of Europe came in closer contact with that of the East. Inspired by their religious fervor a number of gifted Jesuit missionaries came over to the East and brought with them the new astronomy from Europe. The purpose of this paper is to explore the impact of these Jesuit astronomers on the astronomical traditions of the two ancient countries—India and China.

The Background of Jesuits

The Jesuits, who brought the science of Europe to India and China, belonged to a priestly order—"The Society of Jesus". The Society, with its head office in Rome, was founded by a Spanish soldier, Ignatius of Loyola, in 1539, in order to defend and propagate the Catholic faith. The founder, Ignatius, ordained strict discipline for its members, and they were required to take a special vow of obedience to the Pope[1]. Consequently, the Society was considered the loyal champion of the papal authority during the 17-18th century.

Jesuits stressed learning. They cultivated scholarship among themselves, and by the 17th century had quite a few eminent mathematicians and astronomers within their ranks. But as it has been pointed out, their cultivation of scholarship did not imply any open-mindedness towards new ideas[2]. Rather, it constituted an intelligent effort to enhance with its support the power and prestige of their church. Scholarship to them was a means of impressing others, and a tool of providing explanations of the new discoveries according to the established orthodox dogma of the Catholic church. And, when such explanations were difficult to come by for certain discoveries, as in the 17-18th century, they did not hesitate to oppose the discoveries and the ideas based upon them.

The Jesuit Astronomers in India

Since the Society of Jesus was founded for the propagation of the Catholic faith, it is for proselytizing that the Jesuits came to the East. In 1540, they landed at Goa and soon thereafter sailed over to Japan and China.

Before the beginning of the 18th century, apparently, there were very few Jesuits in India, with any meaningful interest in astronomy. As a matter of fact, Anthony Rubino (1578-1643) seems to be the only one among the early Jesuits who displayed any interest in this science[3]. Rubino having received the news of the invention of the telescope, requested his superiors at Rome in 1612, to send him a model of it soon[4]. Rubino was essentially a cartographer, and was for a time being employed in the service of a local king. He possessed ephemerides of a Paduan astronomer Magini, and tried to calculate distance between Venice and the local towns by observing a number of lunar eclipses.[5]

The Jesuit missionaries of the 18th century included a number of astronomers. These astronomers such as Mauduit, Boudier, Calmette, Gargam and Duchamp were mostly French.[6]

Mauduit claims to have successfully predicted a lunar eclipse on March 23, 1701, and publicized it to the neighbouring towns[7]. He apparently had access to the European

tables (Rudolphine perhaps), and persumably had an accurate knowledge of the local longitude.

A few years after Mauduit, in 1734, Fathers Pons and Boudier, with an invitation from Jai Singh, travelled from their mission at Chandernagore in Bengal to Jaipur[8]. Boudier evidently possessed a 17 ft. long telescope and an astronomical timepiece which he carried with him on his journey. He measured latitudes and longitudes of the cities and towns on the way, altitudes of prominent stars, occultation of the Jovian satellites and recorded an eclipse of the sun at Delhi on May 3, 1734[9]. Boudier's latitude measurements of the observatory sites at Delhi and Jaipur are off by about 35″. His longitude measurements done by observing the occulation of the satellites of Jupiter, and with his own timepiece refer to the Paris meridian. Boudier communicated his data to his friends in Paris and to his fellow Jesuit Gaubil in China[10]. Gaubil, who had full access to Boudier's data, comments that Boudier was unaware of stellar aberration and also wrong in other aspects.[11]

Although, Boudier reports having taken data at the observatory sites of the Raja, he does not indicate if he did so with the observatory equipment. He also does not say much about the observatories themselves except that "Bramins were busy observing at Jaipur, day and night".[12]

After Boudier returned to his mission in French Bengal, his place was taken by two Bavarian priests Anthony Gabelsberger and Andrew Strobl[13]. Strobl was a mathematician and carried out calculations for the Raja. However, Strobl has left no account as to the nature of his calculations. The calculations might have concerned lunar problems as Jai Singh's main interest at the time was lunar astronomy.[14]

In a letter, Strobl makes a curious observation. He writes that Jai Singh had worked on a *perpetual motion* machine, and had spent a sizeable sum, 50,000 guilders, on it![15]

Attracted by Jai Singh's astronomical pursuits, a Tyrolian Jesuit, Joseph Tieffenthaler came to India in 1743[16]. But owing to the untimely death of the Raja a few months earlier, his intention to seek an employment at the observatories could not be fulfilled. Unable to find any suitable employment at Jaipur or elsewhere, Tieffenthaler roamed about the country measuring latitudes and longitudes of the places, and fulfilling priestly obligations as needed. He wrote a number of books on India, chiefly for the benefit of his friends in Europe.

The Jesuit Fathers Duchamp, Gargam and Calmette, the contemporaries of Boudier also collected data similar to Boudier and communicated it to their friends in China and France. Gaubil in China acknowledges receiving from Duchamp Indian astronomical tables and notes on Hindu astronomy written by Duchamp himself.[17]

The Jesuit astronomers had many formal or informal exchanges with their Indian counterparts. For instance, Mauduit was prompted to undertake his eclipse calculations after he had detected errors in the calculations of the local Brahmins[18]. He also appears to have had a lively discussion with them regarding the cause of eclipses[19]. Duchamp studied Hindu astronomy and[20], as mentioned earlier, wrote a treatise on it. Boudier engaged the Jaipur Brahmins in a dispute regarding the antiquity of the Hindu astronomy over the Greek[21]. He also borrowed their data concerning an eclipse[22]. Strobl, apparently, impressed Jai Singh with his calculations to the extent that the Raja decided to house European mathematicians in each of his observatories.[23]

Despite such seemingly close interactions, there is no evidence to indicate that Indian astronomers coming in contact with these Europeans became aware of the theoretical advances in astronomy of the contemporary Europe. The Jesuits did not bring the Copernican revolution with them to the country. In their correspondence there is not a single reference or comment to suggest that there were any Copernicans among them and as such discussed Kepler, Galileo or Newton with their hosts.[24]

Curiously, the Indian astronomers found their measuring instruments, fitted with the Vernier and micrometer of little use. Even Jai Singh, impressed as he was with their mathematical prowess, failed to appreciate and incorporate the cross-hair fitted telescopic instruments in his own observational program.[25]

Jesuits in China

Whereas the Jesuits of India had little impact on the Indian astronomy, the situation in China was different. The arrival of Jesuits in China changed the course of Chinese astronomy for ever. The year 1601, in this regard, may be called the turning point after which Chinese astronomy ceased to remain purely indigenous and began to assimilate Western elements. It's the year when the Jesuit scholar Matteo Ricci came in contact with the court of Ming emperors in Peking. Matteo Ricci was a scholar of great facility and translated European books in Chinese on scientific subjects. Ricci was followed by other gifted scholars who with their knowledge of the Western science gave a good account of themselves and acquired positions of influence and power. Johann Adam Schall von Bell in 1644 became the director of the Imperial Bureau of Astronomy. The directorship of this important bureau remained in the Jesuit control thereafter for almost 150 years, until the end of the 18th century.

The successor of Schall von Bell, Ferdinand Verbiest, a Belgian Jesuit is credited with the renovation of the Peking observatory in 1673. The priest also cast 132 cannons for the imperial army[26]. Although the renovation of the observatory was complete in about a year its elaborate equatorial armillary sphere was added much later, in 1744. A great deal of work was done, at the observatory, of which the publication of a catalog of 3,083 stars by Koegler and da Rocha in 1757, was the crowning feature.[27]

The telescope was brought to China in 1618 by Father Johannes Terrentius or Johann Schreck, and in 1626 Adam Schall von Bell wrote a treatise on it. Records indicate that a telescope was presented to the emperor in 1634. Refinements of the telescope such as the cross-hair and the micrometer were also brought subsequently.[28]

With the directorship of the Astronomical Bureau in their hands the Jesuits exercised considerable influence on the course of Chinese astronomy. For instance, the calendar was reformed, better methods of eclipse prediction introduced, and advanced techniques of instrument making became known. In mathematics, Euclidian geometry and logarithmic methods of computation were taught. A large number of books were also written or translated into Chinese. Father Koegler wrote a treatise on astronomy in 1738. Antoine Gaubil, a highly talented astronomer, wrote a large number of monographs on astronomy including a brief history of Chinese astronomy.[29]

The Jesuit contribution to the Chinese astronomy were noteworthy, nonetheless, there was a negative side to it. The Jesuits were responsible to a certain extent in preventing the Copernican revolution from entering the country. With their control of the Imperial Bureau of Astronomy they advocated the Ptolemic world view to the very end and thus held back the Copernican thought from spreading[30]. In China the revolution had to await until the Protestant missionaries Joseph Edkins, Alex Wylie and John Fryer, arrived in the early 19th century.[31]

Strangely, the Jesuits of the 18th century did have access to the "Copernican literature". In a letter, Gaubil acknowledges receiving a copy of Newton's *Principia* from a friend in Europe[32]. Gaubil also writes that his contemporary Koegler, the director of the Bureau of Astronomy employed Newton's methods in computing lunar positions[33]. And yet the treatise on astronomy written by Koegler, almost half a century after the publication of the *Principia* is Ptolemic in nature[34]. In the Jesuit letters of this period, particularly in the voluminous correspondence of Gaubil, where he frequently refers to the works of his fellow Jesuits, and in his own writings, there is little to suggest that the Chinese Jesuits did any thing to spread the heliocentric theories of Copernicus and Kepler.[35]

Jesuits and Copernican Revolution

Behind the Jesuit reluctance of transmitting the Copernican revolution to their host countries the attitude of the Catholic Church played a decisive role. The Church from the very outset had looked upon the heliocentric theory unfavorably, and its opposition to it is now a well documented fact.[36]

The Jesuit attitude toward the Copernican revolution, reflecting the views of their church, had three distinct phases to it punctuated by the two condemnations of Galileo of 1616 and 1633. Prior to 1616, the Jesuits in Italy and everywhere else, dazzled by the telescopic discoveries of Galileo, and also in the absence of any clear guidelines from

their superiors, were undecided and divided on the question of the Copernican scheme. There were some who favored it whereas others opposed. For instance, Christopher Grienberger, a professor of the Roman college favored it.[37] As a matter of fact he even defended Galileo from the attacks of a fellow Jesuit. Wenceslans Kirwitzer, a young Jesuit missionary to China, was also a Copernican.[38] Kirwitzer in a letter criticizes Ptolemy and then in another supports Copernicus.[39] A few Chinese books which have heliocentric theory in them belong to this period.

However, after 1616 the situation changed. The period between 1616 and 1633 may be called the duration of the second phase. In 1616, alarmed by Galileo's somewhat open advocacy of the heliocentric theory the theologians of Rome issued their famous injunction.[40]

"The proposition that the sun is the center and does not revolve about the earth is foolish, absurd, false in theology because expressly contrary to Holy Scripture."

As faithful servants of the church, the Jesuits had no choice but to mould their views accordingly. Their training, absolute discipline and total obedience to their superiors had left them hardly capable of thinking otherwise. Consequently, after the injunction of 1616 the Jesuit astronomers completely disassociated themselves from the Copernicanism.

After dissociating themselves with the Copernicanism, however, certain Jesuits picked up the Tychonic System. The System was not only modern but preserved the geocentric aspect of Ptolemy. The appearance of Tychonic system in Chinese books after the mid-17th century may have its source in some Jesuit remarks of this period.

After the final condemnation of Galileo in 1633, orders were sent to archbishops, bishops, nuncios, and inquisitors of Italy admonishing to inform their parish priests the sentence and recantation of Galileo. The order went on:

"That you and all professors of philosophy and mathematics may have knowledge of it, that they may know why we proceeded against the said Galileo, and recognize the gravity of his error, in order that they may avoid it, and thus not incur the penalties which they would have to suffer in case they fell into the same."[41]

The papal order precipitated the final phase during which even the Tychonic system was given up and strict adherence to Ptolemy prevailed.[42] The books written after this period by the Jesuits are all Ptolemic. In the encyclopedia of mathematics of 1645, the author Adam von Bell advocates the Ptolemic system.[43] It has already been pointed out that a treatise written in 1738 by Koegler a century after Galileo's final condemnation was Ptolemic.

Strictly speaking, the papal injunctions did not apply against the elescope; the

telescope could still be used. This explains why Jesuits such as Koegler, Gaubil, Boudier, Duchamp and others, occupied themselves primarily with the observational aspects of the neoastronomy and shied away from its theoretical advancement.

Furthermore, according to Cardinal Bellermine, the foremost theologian of the 17th century, a person could use the theory as a mathematical device to solve astronomical problems, provided the theory was not upheld by him as a truth. It's this interpretation of the injunction that clarifies why Koegler used the Newtonian method in his calculations and yet advanced the Ptolemic system in his treatise.

Conclusion

The Jesuits did not spread the Copernican revolution in the East. As a matter of fact they were not expected to do so either. They had come to the East to seek converts to their faith and were not about to engage in an activity that contradicted their own theological beliefs and that had been branded heresy, infidelity and atheism by their superiors.

Despite the Jesuits the Copernican revolution could have come to the countries sooner had their own scholars been a little less biased. The Indian and the Chinese scholars had such an inflated outlook of their own culture and science that they were unwilling to concede any thing significant coming out of the West. Consequently no one considered it worthwhile to take a voyage to Europe himself in order to get a first hand information.[44]

In India the Jesuit impact on the indigenous astronomy was minimal whereas in China, at best, it was mixed.

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Notes and References

[1] *Encyclopaedia of Science and Religion*, 7, pp. 500-505, (edit. by J. Hastings, Charles Scribner's Sons, New York).
[2] Geymonat, Ludovico; *Galileo Galilei*, p. 74, McGraw-Hill, New York, 1965.
[3] Archivio della Pontificia Universita Gregoriana, 534, ff., 55; cited by D'Elia, Pasquale M., *Galileo in China*, pp. 15-17; tr. Suter *et. al.*, Harvard U. Press, Cambridge, 1960.
[4] *Ibid.*, p. 16.
[5] *Ibid.*, pp. 15-16.
[6] These Jesuits were stationed at the French enclaves in Bengal, and in South India. *Lettres Editiantes et Curieuses, Memoires des Indes*, Toulouse, 1810.
[7] *Lettres Edifiantes et Curieuses*, Tome Deuxieme, pp. 307-308, Paris, 1843.
[8] *Ibid.*, pp. 772-778.

[9] *Ibid.*
[10] Gaubil, Antoine; *Correspondence de Pekin*, 1722-1759; p. 585, 655, Librainie Droz, Geneve, 1970.
[11] *Ibid.*, p. 656.
[12] Ref. 8.
[13] Stocklein, Joseph; *Neuve Weltbott.* No. 643, 644, Augsburg and Gratz 1728.
[14] Ref. 7, pp. 610-611.
[15] Ref. 13., No. 644, p. 15.
[16] Maclagan, E., *Jesuits and the Great Mogul*, p. 137, Burns Oats and Washborne, London, 1932.
[17] Ref. 10, p. 225, 372, 613.
[18] Ref. 7.
[19] Ref. 7, p. 307.
[20] Ref. 10, p. 225.
[21] Ref. 16, p. 134.
[22] Ref. 7, p. 778.
[23] Ref. 13.
[24] The author has not been able to verify the letter quoted by Moraes in which Fr. Figuerado discusses Copernicus etc. with Jai Singh. See Moraes, George M.; Astronomical Mission to the Court of Jaipur, *J. Bombay Roy. Asiatic Soc.*, 27, 61, (1951). The reference quoted in the paper is *Lettres Edifiantes et Curieuses* Vol. xiv, p. 337, 1781. The editions of 1810 and 1843 of the *Lettres* that the author had opportunity to consult do not include such letter.
[25] Jai Singh wanted to import mathematicians. Further, his instruments do not incorporate the telescopic sight.
[26] Harney, Martin P., *The Jesuits in History*, p. 231, Loyola University Press, Chicago, 1962.
[27] Needham J., *Science and Civilization in China*, Vol. 3, p. 454, Cambridge University Press, 1959.
[28] *Ibid.*, p. 438.
[29] Ref. 10, pp. 884-910.
[30] Needham has also arrived at this conclusion. See Ref. 27, p. 443.
[31] Szczesnic, B., Notes on the Penetration of the Copernican Theory into China, *J. Roy Asiatic Soc.* p. 30. (1945).
[32] Ref. 10, p. 376.
[33] Ref. 10, p. 643.
[34] Taton R., *The Beginnings of Modern Science*, p. 587, Basic Books Inc., New York, 1958.
[35] *Lettres Edifiantes et Curieuses, Memoires de la Chine*, Nouvelle Edition,Toulouse 1810, also Gaubil, Ref. 10.
[36] de Santillana, Giorgio; The Crime of Galileo, University of Chicago Press, Chicago, 1955.
[37] D'Elia, Pasquale m.; *Galileo in China*, p. 13., tr. Suter R. and Sciascia M., Harvard University Press, (Cambridge, 1960).
[38] *Ibid.*, pp. 15-16.
[39] *Ibid.*
[40] White, A.D., *A History of the Warfare of Science with Theology*, p. 132, reprinted by the Free Press, New York, 1965.
[41] *Ibid.*, p. 139.
[42] Needham, Ref. 27, p. 445.
[43] Ref. 31.
[44] In this regard Jai Singh seems to be a remarkable exception. However, due to a variety of reasons his mission to Europe was only partly successful.