

Western Science, Cosmological Ideas, and the *Yijing* Studies in Seventeenth- and Eighteenth-Century Korea*

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1. Western Science in Seventeenth- and Eighteenth-Century Korea: Some Preliminary Questions

When Western scientific knowledge entered Korea in the early seventeenth century, it slowly infiltrated the learned circles, and the Korean intellectuals gradually accepted it. For example, Western astronomy, which proved to yield more accurate predictions—especially of the eclipses—than those using the traditional calendrical astronomy, was accepted by many Korean scholars of the time. The Chosŏn 朝鮮 government even took initiatives to adopt the *Shixianli* (*Sihŏn-ryŏk* 時憲曆) based on Western astronomy. Also, the Western world maps created a great impression, and helped broaden the

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geographical knowledge of Korean scholars. And along with these scientific ideas and theories, there was much interest in scientific instruments from the West, especially the clocks.¹

A set of questions immediately arise. Why did the Chosŏn government adopt a calendar of an essentially Western origin? What were their intentions? It was not only the government, but there were some Korean intellectuals in the seventeenth century who accepted Western astronomy. Why did they?

Was it because Western astronomy was superior to—more accurate, more efficient than—the traditional calendrical astronomy? Can one then say that it was possible to make such a judgment of superiority because of the nature of science which is "objective," "neutral," and "universal"? And even if one knew that a Western science was indeed superior to its traditional counterpart, why should one take the trouble of replacing the old, familiar science in favor of a new, foreign (barbarian) science?

Or, was Western astronomy accepted because it was "useful"? The answer to this question should certainly be yes, but such an answer does not tell us much, for there could be different kinds of usefulness—practical and otherwise. In what ways was Western astronomy useful to the government and to those thinkers who accepted it? What were their notions of the usefulness of Western astronomy?

One source of the usefulness is "better," "more" knowledge. For example, Western science could be considered useful in such aspects

1. Pak Sŏng-rae 朴星來, "Han'guk kŭnse-ŭi sŏgu kwahak suyong" 韓國近世의 西歐科學 수용 (Adoption of Western Science in Early Modern Korea), *Tongbang hakchu* 東方學志 20 (1978), 257-292.

as the accuracy of the calendrical calculation using Western astronomy, the richness of geographical information in the world maps, and so on. But other kinds of usefulness could be found as well. Some could see "usefulness" in the geometrical, structural mode of the Western cosmological thinking and discourse, in particular its capacity to explain the "reason why" (*suoyiran* 所以然) of astronomical phenomena and to represent the actual physical structure of the world.² Another interesting example of the notion of "usefulness" can be seen in Xu Guangqi 徐光啓 (1562-1633), who considered that the main purpose of translating Euclid on which he collaborated with Matteo Ricci (1552-1610) was to show that the Christian doctrines "can be believed without doubt."³ In this case, the usefulness of science was used by its transmitters for their own religious purpose.

Or, was Western astronomy accepted by the Koreans because the Chinese had already accepted it? And if that was indeed the case, can we see this as the mere continuation of the long-term practice of the Korean government adopting the newly established official calendar of China?

It might also be asked whether Western astronomical knowledge was accepted because it is usually not very difficult to accommodate a foreign science in the general metaphysical system of an accepting culture, especially when such a system is flexible and adaptable. For example, as we shall see later, some Western cosmological knowledge could be rather easily incorporated by eighteenth-century Korean scholars into the traditional cosmological system based on the *Yijing*

2. John B. Henderson, "Ch'ing Scholars' Views of Western Astronomy," *Harvard Journal of Asiatic Studies* 46 (1986), 121-148, on pp. 125-128.

3. Xu Guangqi ji 徐光啓集 (Beijing, 1963), p. 75

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And what about other Western sciences and techniques, such as Euclidean geometry, world-maps, firearms, and agricultural techniques? Were the Western world maps, for example, accepted because of their accuracy or usefulness? Or was it because these maps satisfied their curiosity?

These are all important questions, and to answer them, we need to understand the situation surrounding these cases of "scientific transmission" in more detail and depth, for which a great deal more work is necessary.

2. Western Cosmological Ideas

One thing we know for sure is that once they accepted the Western scientific knowledge, the Chosŏn scholars of seventeenth and eighteenth centuries, who were imbued with sŏngnihak (性理學), the Korean version of the Zhu Xi 朱熹 (1130-1200) neo-Confucianism, had to deal with other things that came with the scientific knowledge—the Christian religion and the Western cosmological ideas in particular.

Christian beliefs and practices, which accompanied Western scientific knowledge as it was brought into the East Asian world by the Jesuits, posed problems to Confucian thinkers of the time. In general, the Confucian scholars did not accept those religious beliefs and practices. But they could accept the Western scientific knowledge because they could treat it separately from the Christian religion; in their minds the connection between them was not essential.

The situation concerning the cosmological ideas associated with

Western scientific knowledge was different. Unlike the Christian theological ideas, those Western cosmological ideas were intimately connected with Western scientific knowledge. In fact, Western cosmology was the basis of Western scientific knowledge—calendrical astronomy, world maps, etc.—and thus the Confucian thinkers could not treat them separately, accepting the scientific knowledge while rejecting the cosmological ideas associated with it. And problems arose because Western cosmology contained some ideas that were in conflict with the traditional East Asian world-view.

Western cosmological ideas met with various different responses from Korean thinkers. Not only were there different responses from different individuals, but their attitudes also varied accordingly to different cosmological ideas. Such differences were most conspicuous with respect to two cosmological ideas that came from the West: the earth's sphericity (*diqu* 地球) and the earth's rotation (*dizhuan* 地轉). Whereas both ideas were novel—and out of place—in the established world-views of East Asia, the degree to which they were new was different. And reflecting this difference, there was a subtle difference in the way Korean thinkers of seventeenth and eighteenth centuries responded to the two ideas. The difference of the places of the two ideas in the West at the time when they were transmitted to the East Asian world created further differences.

1) The Earth's Sphericity

We know more or less about the situation, both in the West and in East Asia, surrounding the idea of a spherical earth. Its origin was the West, where it was an integrated part of the established

world-view. The idea of a spherical earth at the center of the world had been firmly embedded in the Western natural philosophy from ancient times.

In East Asia, on the other hand, the idea was altogether new, directly in conflict with the basic components of the traditional cosmology. First, there was the widely held ancient idea of "the circular heaven and square earth" (*tianyuan difang* 天圓地方).⁴ We know, of course, that this expression did not mean a literally square earth, but it is difficult to deny that the idea would have made it difficult to think of a spherical earth. And although there were some expressions in the pre-Jesuit Chinese texts that seem to imply a spherical earth, some of which were even used as evidence of the existence of pre-Jesuit Chinese ideas of a spherical earth, such interpretations do not survive a close scrutiny. For example, there was the bird's egg analogy in which heaven and earth are respectively compared to an egg-shell and egg-yolk.⁵ Yet the emphasis in this analogy was on the spherical and shell-like shape of the heaven's vault and on the complete enclosure of the earth by the heaven, and not on the shape of the earth. Another example was the knowledge of the variation of the height of the North Pole, i.e. that the elevation of the North Pole Star from the horizon becomes higher

4. For a brief account of this idea in ancient China, see John S. Major, *Heaven and Earth in Early Han Thought: Chapters Three, Four, and Five of the Huainanzi* (Albany: State University of New York Press, 1993), pp. 32-35.

5. This analogy first came up in Zhang Heng 張衡 (78-139) and Wang Fan 王蕃 (228-266), and quoted repeatedly by subsequent writers, including Zhu Xi. See, e.g., Cheng Wenguang 鄭文光 and Xi Zezong 席澤宗, *Zhongguo lishi shang de yuzhou lilun* 中國歷史上的宇宙理論 (Theories of the Universe in Chinese History) (Beijing: Renmin chubanshe 人民出版社, 1975), pp. 69-70.

as one goes northward and lower as one goes southward. This well-known fact could very easily be explained based on the idea of a spherical earth. But it was not impossible to explain the fact in terms of a flat earth, which was what the traditional East Asians did.⁶ Although these two ideas were among the main evidences used by the Jesuits in arguing for a spherical earth,⁷ no East Asian thinker seems to have done so before them. Indeed, I have yet to see an example which shows the existence of the idea of the spherical shape of the earth before the coming of the Jesuits.

On the other hand, there is ample evidence for the absence of the idea in traditional East Asia. The idea never came up in pre-Jesuit discussions of the phenomena that we know result from the spherical shape of the earth and thus can easily be explained by the idea of a spherical earth. For example, it was widely known that there are regions in the far north where nights are short and not quite dark, but the idea of a spherical earth, which would have explained the phenomenon easily, seems never to have occurred to anyone who discussed it. Similarly, the record in the *Old Tang History* (Jiu Tangshu 舊唐書) of a man who had navigated the far south and

6. Although Joseph Needham, in his discussion of an imperial commission for the exact determination of the changes in the length of gnomon's shadow over varying latitudes, bases his interpretation on the idea of a spherical earth, nowhere in his long discussion can we find actual evidence for a spherical earth; the whole discussion can be repeated in terms of a flat earth. Joseph Needham *et al*, *Science and Civilisation in China* (Cambridge: Cambridge University Press, 1954-), vol. 4, part I, pp. 43-55.

7. Chen Meidong 陳美東 and Chen Hui 陳暉, "Mingmo Qingchu xifang diyuanshuo zai Zhongguode dianfa yu fanxiang" 明末清初西方地圓說在中國的傳播與反響 (The Transmission of the Western Round-Earth Theory in China in Late Ming and Early Qing, and Responses to It), *Zhongguo keji shiliao* 中國科技史料 21 (2000), 6-12.

observed the Old Man Star (Laorenxing 老人星) not seen in China did not lead anyone to imagine the possibility of a spherical earth.⁸ And although there is a mention of a wooden sphere model of the earth in the *Yuan History* (Yuanshi 元史) record of the Western astronomical models and instruments, it does not seem to have aroused interest in the possibility of a spherical earth.⁹ Even the curved shape of the shadow on the moon during the lunar eclipse, which in the West was among the key evidences for the earth's spherical shape, did not lead traditional East Asians to think of a spherical earth.¹⁰ Indeed, in pre-Jesuit East Asia, there was no discussion of the problems that the idea of a spherical earth would have raised (for example, whether people live on the opposite side of the earth, and if so how they could stand on earth), and this provides ample evidence that there was no deviation among traditional East Asian thinkers from the common-sense notion of a flat earth, consonant with ordinary experiences.¹¹

What was in a more serious conflict with the notion of a spherical earth was the idea—or ideology—of the "Central Culture" (*Zhonghua* 中華). The idea of a spherical earth upset the accepted world order

8 *Jiu Tangshu*, modern punctuated edition (Zhonghua shuju 中華書局), pp. 1303-1304

9 *Yuanshi*, modern punctuated edition (Zhonghua shuju), p. 999.

10 On the contrary, it made a man like Zhao Youqin 趙友欽 (1271-1335?) conclude that since it is spherical it cannot be the earth's shadow. See Zhao Youqin, *Gexiang xinshu* 革象新書, (*Sigu quanshu* 四庫全書 edition), p. 249, Pingyi Chu, "Trust, Instruments, and Cross-Cultural Scientific Exchanges: Chinese Debate over the Shape of the Earth, 1600-1800," *Science in Context* 12 (1999), 385-411, on p. 389.

11. Note, on the other hand, that the question of why man on earth (if the earth moves) does not feel its movement was discussed by the traditional Chinese as we shall see later.

of the Chinese, namely that China, the "Middle Kingdom," was at the center of the world, which entitled the Chinese to enjoy the "Central Culture." The central position of China on the surface of the flat earth was so important an element of the Chinese—East Asian—world-view that it could be compared only with the central position of man in the traditional earth-centered world-picture of the West. Yet, if the earth was spherical, there could not be a single center on the earth's surface, and this would have a devastating implication similar to that of the Copernican shattering of the man-centered universe.

Thus naturally, many Chinese thinkers—Yang Guangxian 楊光先 (1597-1669) and Wang Fuzhi 王夫之 (1619-1692), for example—opposed the idea of the spherical earth when it entered China. And many conservative Korean Confucian scholars, such as Yi Kan 李柬 (1677-1737) and Yi Hang-no 李恒老 (1792-1868), shared the skepticism of the conservative Chinese toward the idea.¹² There were continuing debates, and at times even persecutions of those who worked on the

12 Chu, "Trust, Instruments, and Cross-Cultural Scientific Exchanges"; Ku Man-ok 구만옥, "Chosŏn hugi ch'igu'sŏl suyong-ŭi sasangsajŏk ŭiŭi" 朝鮮後期 '地球說' 受容의 思想的 의의 (The Intellectual Historical Significance of the Acceptance of the Theory of "the Spherical Earth" in Late Chosŏn) *Han'guksa-ŭi kujŏ-wa ch'ŏn'gae—Ha Hyŏn'gang kyosu chŏngnyŏn kanyŏm nonch'ong* 韓國史의 構造와 展開—河炫綱教授定年記念論叢 (Seoul, 2000), pp. 717-747, Im Chong-tae 임종태, "To-ri-ŭi hyŏng'isanghak-kwa 'hyŏng-ki'-ŭi kisul—sipkusegi chungban han chujahakcha-ŭi nun-e pich'in Sŏyang kwahakkisul-kwa segye: Yi Hang-no (1792-1868)" '道理'의 형이상학과 '形氣'의 기술—19세기 중반 한 주자학자의 눈에 비친 서양 과학기술과 세계 李恒老 (1792-1868) (The Metaphysics of 'Dao and Li' and the Technology of "Physical Form and Qi"—The Western Technology and the World Viewed by a Confucian Scholar of the Zhu Xi School in Mid-Nineteenth Century: Yi Hang-no), *Han'guk Kwahak-sa Hakhoe-ŭi* 한국과학사학회지 (Journal of the Korean History of Science Society) 21 (1999), 58-91

new calendars based on Western astronomy. But the persecutions were usually on political grounds, as the world-order of *Zhonghua*, which the idea of a spherical earth threatened, was as much political and cultural as it was cosmological. No one was persecuted for the idea of the spherical earth alone.¹³

Yet, there were those who accepted the idea, mainly owing to the accuracy of calendrical computations based on Western astronomy, which in turn was based on the notion of a spherical earth. In addition to such early converts like Xu Guangqi and Li Zhizao 李之藻 (1565-1630), many seventeenth- and eighteenth-century scholars like Fang Yizhi 方以智 (1611-1671), Mei Wending 梅文鼎 (1633-1721), Jiang Yong 江永 (1681-1762), and Dai Zhen 戴震 (1724-1777) accepted the sphericity of the earth.¹⁴ When they accepted the idea of a spherical earth, however, these East Asian thinkers felt the need to deal with the "cultural" or "ideological" problems caused by its conflict with the *Zhonghua* theory.

The reactions of Korean scholars are interesting in this respect. Some like Yi Ik 李穡 (1681-1763) and Hong Tae-yong 洪大容 (1731-1783) used the idea of the sphericity of the earth to counter the Chinese *Zhonghua* theory. If the earth is spherical, any place on the

13. For the complex nature of these persecutions, see Yi-Long Huang, "Court Divination and Christianity in the K'ang-hsi Era," *Chinese Science* no. 10 (1991), 1-20, Pingyi Chu, "Scientific Dispute in the Imperial Court: The 1664 Calendar Case," *Chinese Science* no. 14 (1997), 7-34.

14. It is to be noted in passing that since the idea was in such a direct, conspicuous conflict with the basic ideas of East Asian cosmology, the whole process of its introduction, controversy surrounding it, and eventual acceptance of it, could be clearly documented. We shall see that this was not the case with the idea of the earth's rotation.

earth's surface can have an equal claim to be its center. Hong Tae-yong explicitly said that if one stands on the perspective of the West as center, China could become a barbarian land.¹⁵ This could support the "Korean *Zhonghua*" (Chosŏn chunghwa 朝鮮中華) theory, the notion that Korea was now the true bearer of the "Central Culture" since China itself was ruled by the barbarian Manchu.¹⁶ Yi Ik may have meant this when he said that China is a small piece of land on earth, or that a sage could appear in a land other than China.¹⁷

2) The Earth's Rotation

The situation surrounding the idea of the earth's rotation was more complicated. The idea was new in the West, and was in conflict with the established world-view. Thus naturally, the idea had caused a great controversy in the West itself before it came to East Asia. As is well known, the idea was banned by the Church and was suppressed; sometimes those holding the idea were persecuted.

The idea of the earth's rotation was new in East Asia also, but unlike in the West, the possibility of the earth's motions was not ruled out from cosmological discussions of traditional East Asia. Unlike the idea of a spherical earth, there was no essential component of the established cosmology of traditional East Asia that

15 Hong Tae-yong, *Ŭisan mundap* 醫山問答, inner collection (*naejup* 內集), supplements (*poyu* 補遺), 4.21b.

16. On the Korean *Zhonghua* theory, see Chŏng Ok-cha 정옥자, *Chosŏn hugi Chosŏn Chunghua sasang yŏn'gu* 조선후기 조선중화사상연구 (A Study of the Idea of the Korean *Zhonghua* in Late Chosŏn) (Seoul: Ilchisa 일지사, 1998)

17. Ku Man-ok, "Chosŏn hugi 'chigu'sŏl suyong," pp. 740-741.

would block the idea of the earth's motions. To be sure, the above-mentioned idea of "the circular heaven and square earth" could be in conflict with the rotation of the earth. But unless the character "*fang* 方" literally meant "square," it did not make rotation of the earth impossible. Similar was the *Yijing* expression that "the heaven's motion is strong" (*Tianxing jian* 天行健). Although it could mean the movement of heaven, its counterpart expression that "the earth's tendency is *kun*" (*Dishi kun* 地勢坤) did not mean the earth at rest.¹⁸ If anything could be in the way of accepting the idea of the earth's movement, it would have been the common sense objections to the notion. But from very early times the Chinese knew how to handle such objections to the possibility of the earth's movement, arguing from the analogy of man on the boat not feeling the movement, for example.¹⁹

Thus, for the pre-Jesuit East Asians, the earth did not have to be absolutely at rest. Movement of the earth along an orbit was entirely possible, and the rotation on its own axis was by no means ruled out.²⁰ Indeed, various ancient sources have passages that speak of, or

18. Also, while the common association of movement (*dong* 動) with yang and stillness (*jing* 靜) with yin could imply the movement of heaven (associated with yang) and the stillness of the earth (associated with yin), this association did not seem to have actually inhibited the idea of the earth's movement.

19 See, e.g., the Han apocryphal text, *Gaolingyao* 考靈曜, which said, while explaining the "four wanderings" (*siyou* 四遊) of the earth to be mentioned below: "The earth constantly moves and does not stop. [It is] like a man sitting in a boat. The boat moves, but the man does not feel [the movement]." (quoted in *Bowuzhu* 博物志, *Sibu beiyao* 四部備要 edition, 1.1b). Zhu Xi also quoted the passage: *Zhuzi yulei* 朱子語類 (Zhengzhong shuju 正中書局 edition), 96.3a.

20. It might be noted in this connection that such a staunch opponent of foreign ideas as Wang Fuzhu could read the earth's rotation in a passage from Zhang Zai's 張

appear to speak of, the earth's motions. The foremost example is the so-called "four wanderings" (*siyou* 四遊). The true nature of this yearly movement of the earth is not clear. Sometimes it spoke of the ascending and descending of the earth, sometimes the motions of the earth in the four compass directions; but it is clear at least that it does not mean the rotation of the earth on its own axis.²¹ There are other expressions of the earth's motions in various ancient sources,²² and although such expressions began to disappear from about the fifth century A.D. with the general waning of interest in cosmological speculations, Zhu Xi in the twelfth century still spoke of the possibility of the earth's motion.²³ Thus, it is not surprising that the idea of the earth's rotation did not create a great controversy when it entered East Asia. The response to the idea was relatively silent, compared with the noisy controversies caused by the idea of a spherical earth.

Some aspects of the transmission of the idea of the earth's rotation complicated the situation and reinforced the "silence." The timing of the transmission of the idea is one such aspect. It fell in the period during which the idea was officially banned by the Catholic

載 (1020-1077) *Zhengmeng* 正蒙, as we shall see later.

21. The idea of "the four wanderings" appeared in various ancient sources, including the *Zhoubei suanjing* 周髀算經 (ch. 5), and were variously interpreted as movements of the earth, heaven or the luminaries. For brief discussions of "the four wanderings," *Zhongguo tianwenxueshi zhengli yanjiu xiaozu* 中國天文學史整理研究小組, *Zhongguo tianwenxueshi* 中國天文學史 (History of Chinese Astronomy) (Beijing: Kexue chubanshe 科學出版社, 1987), pp. 171-173.

22. Cheng and Xi, *Zhongguo lishi shang de yuzhou lilun*, pp. 105-113.

23. Yung Sik Kim, *The Natural Philosophy of Chu Hsi (1130-1200)* (Philadelphia: American Philosophical Society, 2000), p. 152.

authorities, i.e., between 1616 (when the Copernican idea was placed in the index) and 1757 (when the ban was lifted). The carriers of the idea, in all possibility members of the Society of Jesus which suppressed the idea, further complicated the situation, for they were not in a position to advocate the idea openly. The presence of earlier assertions of the earth's motions added to the complication.

Under this circumstance, many things concerning the transmission of the idea of the earth's rotation were not clear. When and how did the Western idea actually enter the East Asian world? To what extent could the Jesuits discuss—or did they want to discuss, or were they willing to discuss—the idea? To what extent were the East Asians aware of the existence of—and did they have access to—the idea, which was forbidden to the Western transmitters? Is it possible that the whole East Asian intellectual world, including the Korean Confucians, was blocked to this Western idea till the Catholic ban was lifted?

That the earth had not one but two principal motions—the daily rotation on its own axis (*zizhuan* 自轉) and the yearly revolution in its orbit around the sun (*gongzhuan* 公轉)—complicated the already complex situation still further. For the acceptability of the two motions were different, both in the West and in East Asia. In the West, the idea of an orbital revolution of the earth was a more serious problem because it disrupted the man-centered universe by displacing the earth from the center of the world. In contrast, the possibility of an axial rotation could be raised as long as it was not accepted to be true.²⁴ The situation was more or less the opposite in

24. Most of the so-called "forerunners" of Copernicus were speaking of the earth's

East Asia. While the possibility of an orbital revolution was clearly there in the traditional cosmological discussions (for example in the above-mentioned theory of the "four wanderings"), the possibility of an axial rotation was not so.²⁵ Thus, we are faced with a complicating, even an ironical, situation in which the Jesuit transmitters were more strictly forbidden to speak of the earth's orbital revolution to which the East Asian world would have been more receptive.

This complicating situation involving the idea of the earth's rotation makes it very difficult to document the process of its transmission from the West to East Asia. Perhaps it is impossible even to determine how and where the East Asian thinkers got the idea. This is in sharp contrast to the case involving the idea of a spherical earth, the introduction, controversies and eventual acceptance of which in East Asia could be more or less fully documented as we have seen.

What is clear, however, is that some East Asian scholars began to speak of the rotation of the earth soon after the arrival of the Jesuits. Although it has often been said that the idea of the earth's rotation did not enter China until 1760, when Michel Benoist (1715-1774) wrote about it in the margins of the world map which he presented to the Qianlong 乾隆 emperor,²⁶ the idea seems to have found its way in the writings of many seventeenth- and eighteenth-century East

axial rotation, not the orbital revolution.

25. I have yet to see a post-fifth century East Asian source that unambiguously speaks of the earth's axial rotation.

26. E.g. Nathan Sivin, "Copernicus in China," *Studia Copernicana* 6 (1973), 63-122, on pp. 92ff.

Asian thinkers before then.²⁷

In this situation, some scholars have even suggested that the idea of the earth's rotation was independently discovered (or developed) by some of the East Asian thinkers who spoke about it in the seventeenth and eighteenth centuries. This has given rise to debates involving the originality of their ideas, leading to the questions of whether, and how, they arrived at the ideas of the earth's motions independently from the Western ideas. While names of Chinese scholars like Wang Fuzhi and Huang Baijia 黃百家 (1643-?) have been mentioned in this connection, more frequently noted were the seventeenth- and eighteenth-century Korean scholars, Kim Sök-mun 金錫文 (1658-1735) and Hong Tae-yong.²⁸

27. Yang Xiaoming 楊小明, "Gebaini rixin didongshuo zai Zhongguo de zuizao jieshao" 哥白尼日心地動說在中國的最早介紹 (The Earliest Introduction in China of Copernicus's Theory of the Earth's Heliocentric Motion), *Zhongguo keji shiliao* 中國科技史料 20 (1999), 67-73.

28. E.g., Yi Yong-bŏm 李龍範, "Kim Sök-mun-tŭ chijŏnnon-kwa kü sasangjök paegyŏng" 金錫文의 地轉論과 그 思想的 背景 (Kim Sök-mun's Theory of the Earth's Rotation and Its Intellectual Background), *Chundam hakpo* 震壇學報 41 (1976), 81-107; Yabuuti Kiyosi 藪内清, "Richo gakusha no chikyu kaitensetsu" 李朝科學者の地球回轉說 (The Chosŏn Scholars' Theory of the Earth's Rotation), *Chŏsen gakuho* 朝鮮學報, 49 (1968), 427-434; Ogawa Haruhisa 小川晴久, "Chijŏn(dong)sŏl-esŏ uju muhannon-ŭro—Kim Sök-mun-kwa Hong Tae-yong-tŭ segye" 地轉(動)說에서 宇宙無限論으로—金錫文과 洪大容의 世界 (From the Theory of the Earth's Rotation [Motion] to the Theory of Infinite Universe: The World of Kim Sök-mun and Hong Tae-yong), *Tongbang hakchu* 東方學志, 21 (1979), 55-90; "Higashi Ajia ni okeru chuten(dō)setsu no seiritsu" 東アジアにおける地轉(動)說の成立 (Development of the Theory of the Earth's Rotation [Motion] in East Asia), *Tongbang hakchu* 23-24 (1980), 375-387; Park Seong-Rae, "Hong Tae-yong's Idea of the Rotating Earth," *Han'guk Kwahak-sa Hakhoe-yŏ* 1 (1979), 39-49; Yang Shaoming, "Gebaini rixin didongshuo zai Zhongguo."

3. The *Yijing* Studies

Questions concerning the "origins" of new cosmological ideas are not limited to the idea of the earth's rotation, but can be asked with regard to other examples of Western scientific knowledge and cosmological ideas. Again, we do not have convincing answers to them at this stage, although there have been many conjectures. We have come to understand more clearly, however, that there appeared some Korean scholars who adopted certain Western cosmological ideas and made them part of their own world-view. And when they did, they did so in the framework of "the *Yijing* studies" (*yixue* 易學).²⁹

29. Chŏn Yong-hun 전용훈, "Chosŏn chunggi yuhakcha-ŭi ch'ŏnch'e-wa uju-e taehan ihae--Yŏhŏn Chang Hyŏn-kwang-ŭi *Yŏkhak tosŏl-kwa Ujusŏl*" 朝鮮中期 儒學者의 天體와 宇宙에 대한 이해—旅軒 張顯光의 「易學圖說」과 「宇宙說」 (Confucian Scholars' Understanding of the Celestial Bodies and the Universe in the Mid-Chosŏn: Chang Hyŏn-kwang's *Yŏkhak tosŏl* and *Ujusŏl*), *Han'guk Kwahak-sa Hakhoe-ji* 18 (1996), 125-154; Jun Yong Hoon, "Transformation of the Western Science and Its Role in the Cosmological Discourse in the Late 17th Century Korea," Yung Sik Kum and Francesca Bray, eds., *Current Perspectives in the History of Science in East Asia* (Seoul: Seoul National University Press, 1999), pp. 497-503; Pak Kwŏn-su 박권수, "Sŏ Myŏng-ŭng- ŭ yŏkhakchŏk ch'ŏnmun'gwan" 徐命膺의 易學的 天文觀 (Sŏ Myŏng-ŭng's Interpretation of Astronomy in the Framework of the *Yijing* Studies), *Han'guk Kwahak-sa Hakhoe-ji* 20 (1998), 57-101; Moon Joong-yang, "Traditional Cosmology Associated with the *I-ching* and Anti-Cosmological Discourses in 18th-Century Korea," *Seoul Journal of Korean Studies* 12 (1999), 177-227; Ku Man-ok 具萬玉, "Sip-yuk-segi mal sip-chil-segi ch'ŏ Chujahakchŏk ujuron-ŭi pyŏnhwa—yŏkhakchŏk ujuronk-wa simhakchŏk ch'ŏn'gwan-ŭl chungsim-ŭro" 16세기말~17세기초 朱子學的 宇宙論의 변화—易學的 宇宙論과 心學的 天觀을 중심으로 (Changes in the Cosmology of the Zhu Xi School in Late Sixteenth and Early Seventeenth Centuries: The Cosmology of the *Yijing* Studies and the Views of the Heavens of "the School of Mind"), *Han'guk sasangsa-hak* 한국사상사학 13 (1999), 173-235.

There have been a few scattered works on the existence (and flourishing) of the tradition of "the *Yijing* studies"—or "the studies of images and numbers" (*xiangshuxue* 象數學) in Chosŏn times. We know, for example, that the Korean tradition of the *Yijing* studies can be traced back to Sŏ Kyŏng-dŏk 徐敬德 (1589-1546) and reached a great depth with Chang Hyŏn-kwang (張顯光 1544-1637). In the late seventeenth and the eighteenth centuries the number of scholars interested in the *Yijing* studies increased rapidly; the level of understanding also improved greatly in this period. Most important thinkers, especially those with interest in scientific and cosmological ideas, such as Kim Sŏk-mun, Ch'oe Sŏk-chŏng (崔錫鼎 1646-1715), Sŏ Myŏng-ŭng (徐命膺, 1716-1787), Hwang Yun-sŏk (黃胤錫 1729-1791), Hong Tae-yong, and Chŏng Yak-yong (丁若鏞 1762-1836), showed much interest in the *Yijing* studies.³⁰ Yet, this tradition of the Chosŏn *Yijing* studies has not been studied in depth.

What is clear, however, is that the *Yijing* studies were the basis of the natural philosophies of many Korean Confucians till quite late, well into the nineteenth century. It is significant in this respect that Chang Hyŏn-kwang called his cosmological work "Yŏkhak tosŏl" 易學圖說 (Discussion of the Charts of the *Yijing* Studies) and that Kim Sŏk-mun also called his work "Yŏkhak isipsadohae" 易學二十四圖解 (Interpretation of Twenty-four Charts of the *Yijing* Studies), although what they had in mind when they used the expression "the *Yijing* studies" (*yŏkhak*) was frequently "the studies of images and numbers" (*xiangshuxue*) in general, in the fashion of Shao Yong's (邵雍

30. Ku Man-ok, "Sip-yuk-segi mal sip-chil-segi ch'ŏ Chujahakchŏk ujuron-ŭi pyŏnhwa," pp. 191-201

1011-1077) cosmology rather than the *Yijing* itself. And various elements of the traditional world-views that had no direct connection to the *Yijing* were also incorporated into these works which continued to be referred to as the "*Yijing* studies."

1) Kim Sök-mun

In *Yökhak isipsado ch'onghae* 易學二十四圖總解 (General Interpretation of Twenty-four Charts of the *Yijing* Studies), Kim Sök-mun sketched an outline of his grand cosmological system which was composed of three basic constituents:³¹

1) the cosmological structure of the nine more-or-less concentric heavenly spheres;

2) the cosmogonic remarks at the beginning of Zhou Dunyi's 周敦頤 (1017-1073) *Taiji tushuo* 太極圖說;

3) Shao Yong's theory of cosmic cycles of *yuan-hui-yun-shi* 元會運世.

Kim Sök-mun's cosmological structure of "the nine heavens" (*jiutian* 九天) is drawn in Figure 1, the *Huangji jiutiantu* 黃極九天圖.³² The outermost heavenly sphere, "the heaven of the supreme ultimate"

31 The standard text for the *Yökhak isipsado ch'onghae* is the one appended to Min Yöng-kyu 閔泳珪, "Sip-chül segi Yijo hag'in-tü chidongsöl—Kim Sök-mun-tü *Yökhak isipsadohae*," 十七世紀 李朝學人の 地動說—金錫文の 易學二十四圖解 (A Seventeenth-Century Chosön Scholar's Theory of the Earth's Motion: Kim Sök-mun's *Yökhak isipsadohae*) *Tongbang hakchu*, 16 (1975), 1-44. For discussions of Kim Sök-mun's cosmological theory, see Yi Yong-böm, "Kim Sök-mun-tü chijönnon"; Ogawa, "Chujön (dong)söl-esö uju muhannon-üro"; Jun, "Transformation of the Western Science and Its Role"; Moon, "Traditional Cosmology Associated with the *I-ching*," pp. 183-197.

32 *Yökhak isipsado ch'onghae*, p. 5.

(*taijitian* 太極天), is motionless. The next sphere, "the heaven of the supreme void" (*taixutian* 太虛天), moves extremely slowly, which Kim Sök-mun referred to as "the slightest motion" (*weidong* 微動). As one moves inside, the motions of the heavens become gradually faster: "the heaven of the fixed stars" (*jingxingtian* 經星天), "the heaven of Saturn" (*zhenxingtian* 鎮星天), "the heaven of Jupiter" (*suixingtian* 歲星天), "the heaven of Mars" (*yinghuotian* 熒惑天), "the heaven of the sun's wheel" (*riluntian* 日輪天, which coincides with the heavens of Mercury and of Venus), and "the heaven of the moon's wheel" (*yueluntian* 月輪天). The innermost is "the heaven of the earth's wheel" (*diluntian* 地輪天), the motion of which is the fastest at one rotation every day. And its center is not the center of heaven, but removed from it by 180,000 *li* 里 (1 *li* is approximately 400 meters).³³

Kim Sök-mun used the *Taiji tushuo* in explaining the cosmological structure outlined above. He interpreted the phrase, "The supreme ultimate moves and generates the yang" (*taiji dong er sheng yang* 太極動而生陽), as referring to "the slightest motion" of the heaven of the supreme void emerging from the motionless heaven of the supreme ultimate. The next phrase, "Movement becomes extreme and becomes still" (*dong ji er jing* 動極而靜), was interpreted to mean that the earth moving the fastest appears to people on it as motionless. The phrase, "It is still and generates the yin" (*jing er sheng yin* 靜而生陰), then, meant to him that the earth, considered to be motionless, produces shadow (which is yin) on its surface on the opposite side of the sun. Finally, he took the phrase, "Stillness becomes extreme, and it moves again" (*jing ji fu dong* 靜極復動), to mean that people on earth,

33 *Yōkhak isupsado ch'onghae*, pp. 31a-32a.

apparently at rest, feel that the heaven moves.³⁴

Based on a principle (which he adopted from James Rho's [Luo Yagu 羅雅谷] *Wuwei lizhi* 五緯曆指) that the distance covered by one day's movement of each heaven should be the same (*zhutian nengli bi deng* 諸天能力必等), and using the known value of the circumference of the earth (the daily movement of the earth), 90,000 *li*, Kim Sök-mun could compute the circumference of all the nine heavens, and thus their distances from the center of the heaven. (For example, if the period of rotation of a heaven is *n* days, the circumference of that heaven is *n* times 90,000 *li*.) For the period of rotation of the heaven of the fixed stars, he used 25,440 years, the period of the precession of equinoxes. And for "the slightest motion" of the heaven of the supreme void, he took the angular speed of 1 *xu* 虛 per day, where the "*xu*" is the smallest unit of an angle (1 *du* 度 = 60° *xu*). The period of rotation for the heaven of the supreme void then becomes

$$60^\circ (xu/du) \times 360 (du/circumference) \times 1 (\text{day}/xu) \times 1/365.2425 \\ (\text{year}/\text{day}) = 9.93 \times 10^{15}(\text{years}).$$

The outermost heaven of the supreme ultimate does not move, and its circumference cannot be measured.³⁵

Having accounted for the structure of the world in this manner, Kim Sök-mun went on to deal with cosmological time. He took up Shao Yong's theory of cosmic cycles (1 *yuan* = 12 *hui* = 12x30 *yun* = 12x30x12 *shih* = 12x30x12x30 years), but gave it his own interpretation

34. *Yŏkhak isipsado ch'onghae*, p. 31a, 34a

35. *Yŏkhak isipsado ch'onghae*, pp. 32a-33a.

and went further than Shao Yong. He associated different periodic motions of the heavens, the ecliptic (sun's path), and the earth with these cycles. One day, to begin with, is associated with the daily rotation of the earth. One year is the period of the yearly revolution of the heaven of the sun. The next time unit of which Kim Sök-mun found cosmological significance is 1 *yun* = 360 years, the period of oscillation of the size of the sun's orbit, the ecliptic. His next cosmic period is that of the revolution of the earth along the orbit around the center of the heaven. He took it to be equal to 2 *hui*. But the number he used for *hui* was 12,720 years, and was thus different from that of Shao Yong, 10,800 years. Obviously he chose it to be equal to half the period of the precession of equinoxes (25,440 years). Kim Sök-mun had said earlier that because Shao Yong's numbers did not fit the calendars, he had chosen his own numbers for *yuan* and *hui* that were different from his predecessor's. Finally, one *yuan* for Kim Sök-mun was 60 *hui* = 763,200 years, and is the period of the variation of the angle between the equator and the ecliptic from 0° to 45°. He noted that his *yuan* is approximately 6 times Shao Yong's *yuan*, which is 129,600 years. Kim Sök-mun did not stop here, but went on to speak of still greater cosmic periods even mentioning a period of 763,200⁸ years, which is greater than 10⁴⁸ years.³⁶

Two different motions were assigned to the earth in the course of constructing this system. The idea of the earth's rotation constituted an essential part of this system, in which the motion is the fastest at the center, and slower outside, reaching a complete rest at the outermost. Another kind of motion, namely the revolution around the

36. *Yŏkhak ispsado ch'onghae*, pp. 38b-42b

heaven's center (from which the center of the earth is removed by 180,000 *li*) with the period of 25,440 years, was assigned to the earth to take account of the cosmological cycles. It seems clear that Kim Sök-mun considered this cosmological system to be a coherent one, although, judged from modern criteria, it is a system based more on numerological speculations than on the actual world. And this made some scholars consider that the idea of a rotating earth was the result of Kim Sök-mun's own creative imagination, which he came up with as he tried to construct a coherent cosmological theory.³⁷

Yet, does this mean that Kim Sök-mun came to the idea independently from the Western ideas of the earth's rotation? Again, it may not be possible to reach a conclusive answer to this question. As far as I am concerned, however, I find it extremely difficult to imagine how he could have done so. It seems impossible that he could not have known it was an idea from the West, for Copernicus's idea was discussed in seventeenth-century China.³⁸ It seems far more likely—although I do not have any direct evidence for it—that he had, in some way or other, heard (read) about the idea of the earth's rotation and incorporated it into his cosmological system—or built his cosmological system around the idea. And it needs to be pointed out again in this connection that the Jesuits were free to discuss the possibility of the earth's rotation on its own axis if they were to refute it afterwards.³⁹

37. E.g., Jun, "Transformation of the Western Science and Its Role"; Moon, "Traditional Cosmology Associated with the *I-chung*."

38. E.g., Yang Xiaoming, "Gebaini rexin didongshuo zai Zhongguo."

39. For example, in the *Wuwei lizhi*, James Rho presented the following argument for the possibility of the earth's rotation, which he rejected afterwards.

2) Sŏ Myŏng-ŭng

Of the late Chosŏn scholars, Sŏ Myŏng-ŭng took the system of the *Yijing* studies more seriously than others. Unlike Kim Sŏk-mun, Sŏ Myŏng-ŭng was a mainstream Confucian scholar of a very high official position with a good knowledge of traditional astronomy and Western science. And he was more conscious than Kim Sŏk-mun in accepting the scientific knowledge of Western origin.

Sŏ Myŏng-ŭng's perceptions of the incoming astronomical and cosmological knowledge from the West and of his own natural philosophical system of the *Yijing* studies were set in the so-called theory of "the Chinese origin of Western learning" (*xixue zhongyuan* 西學中源). According to the theory, the Western scientific ideas that came to China had their origins in ancient China. In other words, Chinese had the knowledge of them in the ancient golden ages; such knowledge disappeared later and fell to the hands of the barbarians, who developed it further and brought it back to China.⁴⁰ Many

Now above the earth's surface we see the stars move leftward. But they are not real movements of the stars. The stars do not have the motion of one rotation a day. It is simply that the earth becomes one sphere together with the *qi* and fire, and moves from west to east, one rotation a day. It is like a man traveling on a boat looking at trees and other things on the shore who does not feel that he moves but feels as though the shore moved. The reason (*li*) that people on earth see the westward motions of the stars is the same. In this manner, one can avoid many motions in the heavens by the one motion of the earth, and large rotations in the heavens by the small rotation of the earth. (*Xinfa suanshu* 新法算書 [Sigu quanshu 四庫全書 edition], 36.7b-8a.)

Kim Sŏk-mun quoted Ricci's argument almost *verbatim* in *Yŏkhak isipsado ch'onghŭe*, p. 32a.

40. It is interesting that Ricci also held the view that some ancient Chinese sources and ideas disappeared, although his main aim was to explain that certain Christian

eighteenth-century Korean scholars also accepted this theory, and the historical situation they faced made some of them become ardent adherents to it, sometimes even more ardent than the Chinese.

The so-called theory of "the Chinese substance and Western function" (*zhongti xiyong* 中體西用), which advocated adopting Western science and technology as "functions" (*yong* 用) while holding on to Chinese value and culture as "substance" (*ti* 體), also was relevant to the understanding of Sŏ Myŏng-ŭng's attitude to Western scientific knowledge.⁴¹ For Sŏ Myŏng-ŭng, the Western astronomical knowledge was the "function," while the *Yijing* studies was the "substance." In particular, Sŏ Myŏng-ŭng took Fu Xi's 伏羲 "*Xiantian yi*" 先天易 (the *yi* prior to heaven) as the source, or the substance, while the functions were the computational method of "*gougu*" 句股⁴² and the calendrical astronomy. This was what he meant when he said: "The calendars and the *Yijing* are 'inside and outside' to each other."⁴³

doctrines, though they were also proper Ways, did not appear in the classics because they had been lost. See, e.g., Jacques Gernet, *China and the Christian Impact*, translated by Janet Lloyd (Cambridge: Cambridge University Press, 1985), p. 28. On the theory of the Chinese origin of Western learning, see, e.g., Wang Ping 王萍, *Xifang lishuanxue zhi shuru* 西方曆算學之輸入 (Introduction of the Western Calendrical and Mathematical Learning) (Taipei: Jinghua yinshuguan, 1966); John B. Henderson, "Ch'ing Scholars' Views of Western Astronomy," pp. 139-143; Jiang Xiaoyuan 江曉原, "Shilun Qingdai xixue zhongyuanshuo" 試論清代西學中源說 (An Essay on the Theory of the Chinese Origin of Western Learning in the Qing Period), *Ziran kexueshi yanjiu* 自然科學史研究 7 (1988), 101-108.

41 This theory was to develop into the theory of "Eastern Way and Western instruments" (*tong-do sŏ-gi* 東道西器), the Korean variant of "the Chinese substance and Western function."

42. For a brief discussion of the *gougu* method, see Needham, *Science and Civilisation*, vol. 3, pp 22ff.

Thus, according to Sŏ Myŏng-ŭng, both substance and functions existed in ancient China; afterwards, the functions disappeared from China and went to the West, where they were developed further before coming back to China. But the Western astronomy had deficiencies because it lacked the proper substance. In other words, while the Western astronomy was accurate and efficient in its functions, it was deficient in its substance, i.e. on the side of simple, systematic theory. Sŏ Myŏng-ŭng said:

After the burning [of books] in the Qin, the *Xiantian yi* disappeared into the elixir kitchens; the *gougu* lost its substance, while the *Xiantian yi* lost its functions ... The *gougu* of the Western countries ... is like water without origin, and thus does not see its simplicity truly reaching to the *Xiantian yi*. It is like a tree whose branches are cut off and thus does not see its great flow.⁴⁴

In this way, he could accept, as many of his contemporaries had to, the knowledge of Western astronomy which proved to be more accurate, while pointing out its deficiency of lacking simple, systematic theory. To supplement this deficiency, the Western astronomical knowledge had to be incorporated into the system of the *Yijing* studies, and that was what Sŏ Myŏng-ŭng did.⁴⁵

Sŏ Myŏng-ŭng's discussion of astronomical knowledge was based

43. *Sŏnch'ŏn sayŏn* 先天四演, *Pomanjae ch'ongsŏ* 保晚齋叢書 (Kyujanggak 奎章閣 edition), p. 32.

44. *Sŏn'guye* 先句齋, preface

45. Pak Kwŏn-su, "Sŏ Myŏng-ŭng-ŭi yŏkhakchŏk ch'ŏnmun'gwan." Park Kwon Soo's (Pak Kwŏn-su) work has been the source of my interest in, and much of my knowledge of, this aspect of Sŏ Myŏng-ŭng's thought

on the diagrams related to the *Yijing*, in particular Fu Xi's 伏羲 *Xiantian liushisigua fangyuantu* 先天六十四卦方圓圖 (Figure 2), which Sŏ Myŏng-ŭng considered to be the basis of all natural phenomena, and of numbers. He identified the "Chinese origins" of various specific astronomical knowledge in these diagrams. A good example is the way he identified the "Chinese origin" of the idea of the spherical shape of the earth. He modified the *Xiantian liushisigua fangyuantu* to show that it contained an idea of the a spherical earth: by turning the inside square arrangement of the 64 hexagrams by 90 degrees, a rhombus shape is obtained (Figure 3), which he interpreted as representing a circular shape. He also noted that the idea was already there in the five dots at the center of the *Hetu* 河圖 (Figure 4): "The five [dots] in the center of the *Hetu* form three [dots] horizontally and vertically, and are bulging to become round."⁴⁶ Thus he said: "But the Confucians, always obstructed by the changed orientation of the direction of the inner diagram, doubt the *li* 理 that the earth is round. They really do not know that the *li* of round earth is already manifest in the five [dots] at the center of the *Hetu*."⁴⁷ There are other examples. Sŏ Myŏng-ŭng accommodated into his system of the *Yijing* studies not only the Western astronomical knowledge, but such traditional knowledge as "the nine-fold heavens" (*jiuzhongtian* 九重天), "the leftward rotation of the heaven and the rightward motions of the sun and the moon" (*tian zuoxuan riyue youxing* 天左旋 日月右行), phases of the moon, different climate zones of the earth, and the sun's motion fast at the equinoxes and slow at

46. *Sŏnch'ŏn sayŏn*, p. 51.

47. *Sŏnch'ŏn sayŏn*, pp. 50-51

solstices (*tongsheng zhi cha* 同升之差).⁴⁸

4. The Theory of "the Chinese Origin of the Western Learning"

Sŏ Myŏng-ŭng seems to have felt more keenly than others about the inevitability to accept—or not to avoid—Western knowledge. He said, for example, "How can one dislike something [just] because it has come from a foreign country?"⁴⁹ Naturally, he felt more strongly for "the Chinese origin of the Western learning," which is quite understandable if one considers the intellectual climate surrounding him. After the humiliating defeat to the Manchus in the early seventeenth century, a strong anti-barbarian sentiment, as well as the above-mentioned "Korean *Zhonghua*" theory, was widespread among the Korean Confucians. There was a strong feeling against anything barbarian, including the Western barbarians' scientific knowledge. And along with it, the "*chonjuron*" 尊周論, the tendency of admiring the ancient Zhou 周 culture, the culture that was considered ideal by many neo-Confucians, dominated Chosŏn scholars. The need to legitimize the barbarian knowledge of Western astronomy for the "Central Culture" was especially keen in this atmosphere.

Thus, what we see in seventeenth- and eighteenth-century Korean intellectual circles is a very complex situation involving various

48. Pak Kwŏn-su, "Sŏ Myŏng-ŭng-ŭi yŏkhakchŏk ch'ŏnmun'gwan," pp. 74-89. Pak notes that even the structure of the collection of his writings, the *Pomanyae ch'ongsŏ* 保晚齋叢書, reflects influences from the system of the *Yijng* studies. Pak Kwŏn-su, "Sŏ Myŏng-ŭng-ŭi yŏkhakchŏk ch'ŏnmun'gwan," p. 96.

49. *Piryŏn* 辨禮準, preface

different attitudes towards the classic *Yijing*, the ancient Chinese culture, and Western science. An interesting difference from the situation in China developed. Whereas for the seventeenth-century Chinese the same humiliation gave rise to some critical, soul-searching re-examination and purification of their own tradition—through critical studies of the classics—their Korean contemporaries tended to cling even more strongly to the tradition. While in China there was a partial rejection of the Cheng-Zhu 程朱 school of the Song-Ming neo-Confucianism, a deepening development of it occurred in Korea. Their attitudes to the *Yijing* studies were also different. The Qing Chinese were purging some of its excessive (contaminating) elements, such as the numerological speculations of Shao Yong and Cai Yuanding 蔡元定 (1135-1198);⁵⁰ Koreans like Kim Sök-mun and Sö Myöng-üŋ went on to develop these elements even further.⁵¹

Indeed, this tendency of finding Chinese origins for Western ideas, however peculiar it may appear, is nothing unusual. It is a typical—and natural—attitude of most cultures in accepting ideas from foreign cultures which they consider "barbarian," or "pagan." For once attributed to the ancient golden age of their own tradition, barbarian ideas become much easier for them to accept.⁵² It was not only the

50 John B. Henderson, *The Development and Decline of Chinese Cosmology* (New York: Columbia University Press, 1984), pp. 189-191.

51. Pak Kwön-su, "Sö Myöng-üŋ-üi yökhakchök ch'önmun'gwan"; Moon, "Traditional Cosmology Associated with the *I-ching* and Anti-Cosmological Discourses"; Jun, "Transformation of the Western Science and Its Role."

52 This sort of "Chinese origin" theory was not restricted to scientific ideas. As John Henderson has noted, the medieval Chinese could even find the Chinese origins of Buddhism in Laozi Henderson, "Ch'ing Scholars' Views of Western Astronomy," p. 143.

Chinese who showed this tendency, but some Europeans did, too. For example, Matteo Ricci found Chinese precedents for the idea of a spherical earth in the egg-yolk analogy in ancient Chinese sources.⁵³ Chinese origins of Western ideas were sought not only from the ancient periods, but sometimes from more recent sources. The seventeenth- and eighteenth-century East Asian thinkers' readings—those of Wang Fuzhi, Huang Baijia, Jiang Yong, Kim Sök-mun, Hong Tae-yong etc.—of the earth's rotation in Zhang Zai's 張載 (1020-1077) *Zhengmeng* 正蒙 is a good example.⁵⁴

5. Remaining Questions

The foregoing pages have shown how different attitudes of seventeenth- and eighteenth-century Korean scholars towards Western scientific knowledge were coupled, in a very complicated way, with

53 *Qiangun tiyi* 乾坤體義 (*Sigu quanshu* 四庫全書 edition), *zhuan shang* 卷上, 1a-2a. Joseph Needham resorted to the same kind of arguments, which makes it interesting to note that the two Western intellectual giants with deep emotional attachment to Chinese culture would behave so similarly although they lived more than three and a half centuries apart. See *Science and Civilisation in China*, vol 3, p. 217, p. 498, vol. 4, part I, pp 52-53. This attitude was not restricted to the Europeans looking at the Chinese tradition, but could be discerned from those other Europeans looking at what they consider their own tradition. For example, we can see a similar attitude from the medieval Europeans who took it for granted that the ancient Greek science and learning they got from the Arabs not as something from a foreign culture but as something from their own past golden age, as if they had the right (while the Arabs did not) to consider the ancient Greeks, including those of the Hellenistic age, as their ancestors. The Renaissance artisans' and engineers' inclination to look for precedents and for theoretical bases of their practices in classical sources falls in the same vein.

54. Ogawa Haruhisa, "Higashi Ajia ni okeru chiten(dō)setsu no seiritsu," pp 376-379

different perceptions of the significance of their own natural philosophical tradition. But this aspect of the situation has not been adequately studied so far. Sometimes the issues have become too simplified to do justice to this very complicated situation. There have been many "either-or" type discussions concerning the role of Western knowledge in Kim Sök-mun's and Yi Ik's idea of the sphericity of the earth, and Kim Sök-mun's and Hong Tae-yong's idea of the rotation of the earth. And more recently there also have been some overenthusiastic judgments about the importance of the role played by the traditional natural philosophical system in shaping their views.⁵⁵ A scholar asserted: "Further analysis of Kim Sök-mun's theory on the structures and motion of the heavenly bodies ... reveals that the grounds for these structures and motion were not concepts and epistemological systems of Western astronomy at all but traditional Neo-Confucian epistemological systems."⁵⁶

A set of questions can be raised concerning the case of Kim Sök-mun. How important, for Kim Sök-mun and for his readers, was the cosmological issue of whether the earth moves or not? We have noted that the idea of the earth's motion was not in direct conflict with any basic tenet of traditional East Asian cosmology. Thus it is possible that the issue was not as serious as the one involving the idea of a spherical earth.⁵⁷ But could it have been unimportant for

55. Moon, "Traditional Cosmology Associated with the *I-chung*"; Jun, "Transformation of the Western Science and Its Role"

56. Moon, "Traditional Cosmology Associated with the *I-chung*," p. 188.

57. Not just the idea of the earth's rotation, but also the ideas of infinite universe, of plural worlds, etc., for example, that could be seen in Hong Tae-yong's grand cosmological theory were not in any fundamental conflict with the traditional East

Kim Sök-mun also, who made it an essential ingredient of his cosmological system? And if so, was that the reason why he was silent about its source? In other words, was the issue so unimportant that he did not care to mention its source? Or on the contrary, could he have considered it important enough to feel like hiding it?

Still another question can be asked in this connection. How conscious was Kim Sök-mun about the problem and consequence of accepting an idea from the West? And, did the fact that he was Korean rather than Chinese make it easier for him to accept the Western idea? Or, were his feelings toward the ideas of the Chinese forerunners like Zhang Zai and Zhu Xi different from his feelings towards the Western ideas? It should be noted that Kim Sök-mun must have read about the Western ideas from the books written in Chinese with the authors' names Sincized. He used the same expression, "the calendar specialists" (*lijia*, *yökka* 曆家) in referring to the Western astronomers as well as to the Chinese.⁵⁸

Finally, a question remains: Would the late Chosön scholars have been able to go on incorporating in the *Yijing* cosmological system more and more details of Western astronomical knowledge? Could the *Yijing* system accommodate all of them? Sö Myöng-üng is interesting in this respect, because he did not try to update the astronomical content of his system although we know that he was continuously exposed to the new books of Western astronomy coming

Asian world-view. The source of those ideas were also traced back to such earlier East Asian sources as Shao Yong, Sö Kyöng-dök, and Ch'oe Sök-chöng. On Hong Tae-yong's cosmological theory, see, e.g., Moon, "Traditional Cosmology Associated with the *I-chung*," pp. 212-219.

58. E.g., *Yökhak isipsado ch'onghae*, p. 32a

through China. Did he knowingly (intentionally) ignore the additional Western knowledge? Or was it because what was important to him was the whole cosmological system of the *Yijing*, and not specific concrete astronomical knowledge? At issue here is the problem of priority: Which was more important for him—the significance of the *Yijing* system as a whole, or the accuracy (or correctness) of Western scientific knowledge? And could there possibly have been a reason that would have made him lean toward the latter of the two? Eventually, some late Chosŏn scholars, especially those in later periods, chose to reject the traditional cosmological system based on the *Yijing*: Hong Tae-yong and Chŏng Yak-yong initially, and other thinkers later. Did they do so because they could not accommodate the new Western scientific knowledge in the traditional cosmological system?

Figure Captions.



Figure 1. The Cosmological Structure of Kim Sök-mun: the Huangji jutiantu
黃極九天圖

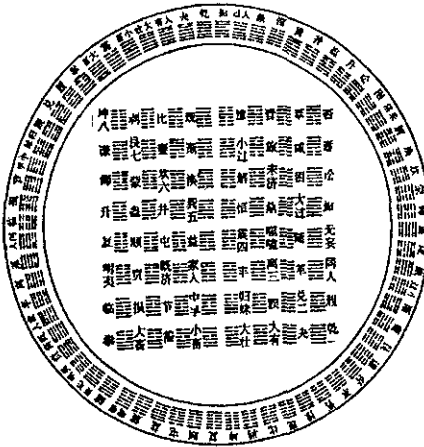


Figure 2. Fu Xi's *Xiantian lushisigua fangyuantu* 伏羲先天六十四卦方圓圖

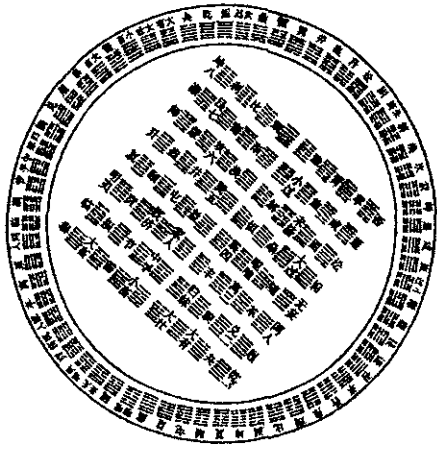


Figure 3. Sō Myōng-ŭng's Version of the *Xiantian liushisigua fangyuantu*

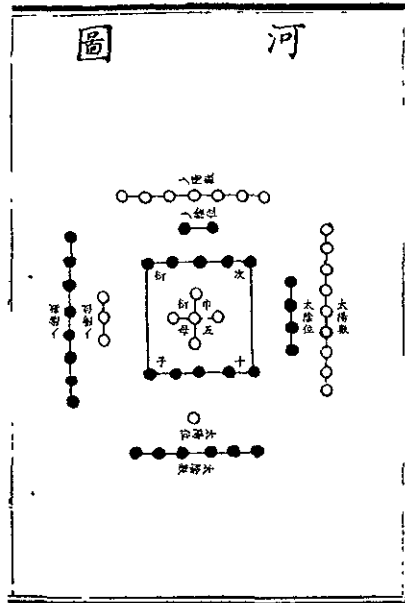


Figure 4. The *Hetu* 河圖

<Abstract>

Western Science, Cosmological Ideas, and the *Yijing* Studies in Seventeenth- and Eighteenth-Century Korea

Kim Yung Sik

When Western science came to Korea in the seventeenth century, the Korean intellectuals of the time showed various different attitudes towards it. The Christian beliefs and practices that accompanied Western science posed problems to most of them, but much of the scientific knowledge did not; the Western scientific knowledge was generally accepted. Yet, Chosŏn scholars, imbued with *sŏngnihak* (性理學), the Korean version of Zhu Xi neo-Confucianism, had to deal with the cosmology associated with the Western calendrical arts, which contained many elements in conflict with the traditional world-view. Some eventually adopted the Western cosmology, and made it part of their own world-view. It is the argument of this paper that when they did, they did so in the framework of the *Yijing* studies and the theory of "the Chinese origin of the Western learning." In presenting this argument, I shall examine the situation surrounding the transmission of the Western ideas of the earth's sphericity and rotation, and look at the works of Kim Sŏk-mun and Sŏ Myŏng-ŭng.