Traditional Cosmology Associated with the
I-Ching and Anti-Cosmological Discourses
in 18th-Century Korea*

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1. Trends and Issues in Cosmological Studies

In-depth research on the knowledge of nature, especially cosmology, of the so-called Silhak ("Practical Learning") or late-Chosŏn Dynasty intellectuals began to be conducted in the 1970's and the 1980's. Researches by Yi Yong-bŏm and Ogawa Haruhisa, however, are interesting because of their extremely opposing judgments on the historical significance of the knowledge of nature held by Silhak intellectuals, on Kim Sŏk-mun's (1658-1735) cosmology in particular. Evaluating Kim's theory of cosmic structure as a Copernican revolution in the traditional geocentric cosmic structure of the Far East, Ogawa assesses him as a figure who, together with Hong Tae-yong, overcame traditional cosmology and advanced a unique,

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systematic, and modern theory of cosmic structure.\(^1\) Yi, on the other hand, focuses on the fact that Kim's cosmological discussion occurred within the framework of traditional epistemological system of yi xue and thus passes a considerably negative judgment, refusing even to treat his cosmology as an accomplishment in the history of science.\(^2\)

Starting in the 1990's, research on the cosmology of Chosŏn Dynasty intellectuals became richer in both quantity and quality.\(^3\)

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Chang Hoe-ik and Chŏn Yong-hun discover aspects similar to the systematic and rational discussions of modern natural sciences in Chang Hyŏn-gwang's (1554-1637) cosmological discussions, which predate the impact of Western science in Korea, and understand this to be the result of Chosŏn Confucians' deepening understanding of Neo-Confucianism in the late 16th century and the early 17th century. Chang Hoe-ik and Chŏn not only view Neo-Confucianism as having made possible the pursuit of a rational and fundamental understanding of nature and as having provided the appropriate epistemological and ontological basis for such pursuit through Chang Hyŏn-gwang, but also go on to claim that new cosmological discussions by figures such as Kim and Hong, which occurred after the introduction of Western science into Korea, were rooted in the rational tradition within the Neo-Confucian understanding of nature, as can be seen in Chang Hyŏn-gwang's case.4

Such positive evaluation of Chang Hyŏn-gwang's Neo-Confucian system of understanding nature, however, directly opposes Yi Yong-bŏm's discussion above. This stems from the fact that, in Yi's view, Chang's cosmology did not in any way distance itself from the Yi-Jing based epistemological system of yi xue, which obstructed the shift to a modern system of understanding nature. Such conflict is most apparent in Chŏn Yong-hun's evaluation of Kim Sŏk-mun. Kim's understanding of nature not only started basically from the Yi-Jing based epistemological system of Shao Yong (1011-1077) of the Song

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4 As for such evaluation of Chang Hyŏn-gwang, see Chang Hoe-ik, op cit, pp 608-09, and Chŏn Yong-hun, op cit (1996), pp. 252-53
Dynasty but even went on to formulate a Yi-Jing based discussion far more advanced and complex than that of Shao. In spite of this, Chŏn highly esteems Kim as a “pioneer who, going beyond the metaphysical rationality of Neo-Confucianism, established a new brand of yi xue that explained the generation, motion, change, and termination of the universe with ‘structural rationality.’”5

Such recent research on the cosmology of Chang Hyŏn-gwang and Kim Sŏk-mun may be seen as progress in that it overcomes previous schematization, which viewed modern Western scientific knowledge of nature and the Yi-Jing based understanding of nature of traditional yi xue as opposites that could never coexist. Indeed, it is historically more appropriate to view traditional epistemological systems such as the Yi-Jing based yi xue not as having competed against Western science but as having played a certain and contributive role in the acceptance of Western science. On the whole, such historical awareness can be applied to the process through which Western science came to be adopted not only in Korea but also in China and Japan.6 Despite this, however, the viewpoint espoused by recent studies on I-Ching-based cosmology, mentioned above, is not entirely indisputable. While it is evident that the I-Ching-based cosmology of Kim Sŏk-mun and Sŏ Myŏng-ŭng played a certain role in the adoption

5 See Chŏn Yong-hun, op cit (1997), pp. 140-1

6 The following thesis is noteworthy for its application of such historical awareness to the process through which Japan accepted and adopted Western science. Wai-mung Ng, “The I Ching and the Adaptation of Western Science in Tokugawa Japan,” Chinese Science 15 (1998), pp. 94-117. In this thesis, Wai-mung criticizes the previous stance of scholars, which viewed the Confucian tradition of understanding nature on the basis of yi xue-associated epistemological system and Western science as competitors and which presumed that Confucian thought fought against Western science, eventually losing and declining. According to him, the Confucian tradition of understanding nature actually came to be naturalized following the introduction of Western science, thus contributing to the process of modernization.
and establishment of a modern scientific understanding of nature in Korea, it is problematic to view the contents of these figures' cosmology themselves as a natural result of historical development. For instance, claiming that Kim Sŏk-mun's and other "late-Chosŏn Dynasty scholars' new cosmology was a fusion of the cosmology of the Neo-Confucian tradition and the cosmology of the astronomical-calendrical tradition," Chŏn Yong-hun praises it as an epoch-making accomplishment in the history of traditional cosmology in Korea.7

Such recent viewpoint that evaluates the I-Ching-based cosmology of late-Chosŏn Dynasty scholars including Kim Sŏk-mun and Sŏ Myŏng-ŭng as historical progress opposes the general viewpoint adopted by Chinese scholars of the history of science regarding I-Ching-based cosmology. Early on, Nathan Sivin evaluated as not only conservative but also abortive the work and accomplishment of Wang Xi-chan (1628-1682), who had selectively accepted Western astronomical knowledge on the basis of traditional astronomy and traditional cosmological system and interpreted it partly in terms of I-Ching-based epistemological system when, during the late Ming and early Qing dynasties, traditional astronomy was declining and superior Western astronomy was being introduced into China.8 In diachronically tracing the historical development of traditional cosmology in China, John B Henderson likewise evaluated negatively the I-Ching-based cosmology of 16th-century Ming China, which saw further development and prevalence of Shao Yong's I-Ching-based cosmological discussion, as "a case where cosmology developed and was disseminated in the most absurd manner" throughout the history of

7 As for the viewpoint that sees Kim Sŏk-mun's cosmology as a historical breakthrough, see Chŏn Yong-hun, op cit (1996), p 151.

Chinese cosmology. According to Henderson, the general course of progressive cosmological discussions in post-Ming Qing China in fact was a negation of *I-Ching*-based cosmology.  

The aim of this thesis then is to adjust such conflicting views on *I-Ching*-based cosmology. First, the historical facts regarding *I-Ching*-based cosmology, which was supplanted by the emergence of modern science, will be examined. This does not mean, however, that the *I-Ching*-based epistemological system competed against the method of understanding nature espoused by Western science. At least, before an in-depth acceptance and establishment of modern Western science in Korea—that is, before the 19th century—late-Chosôn Dynasty intellectuals understood and accepted Western science through traditional *I-Ching*-based epistemological system. Of course, among the intellectuals were those who partly negated traditional concepts and epistemological systems. On the other hand, however, there too existed intellectuals who devised and proposed even more complex and sophisticated *I-Ching*-based cosmology. Nor were such opposing aspects clearly demarcated; there were cases where these two different stances coexisted in the same individual. Rather, such coexistence of traditional epistemological system and Western scientific knowledge can be said to have been a general phenomenon.

This thesis will not attempt a systematic delineation of the cosmology advanced by late Chosôn Dynasty intellectuals, however, because any attempt to understand their cosmology in a systematic manner can distort their ideas. Instead, this thesis will examine the cosmological discussions of representative intellectuals—Kim Sŏk-mun, Sŏ Myŏng-ŭng, and Hong Tae-yong, for instance—of the 18th century,

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a period in which *I-Ching*-based cosmology reached its peak intensification, in terms of two different aspects. The two aspects here will denote the *I-Ching*-based tradition, which is evident from the Shao Yong School, and Western science, which, from the 17th century and onwards, flooded into Korea and had a considerable influence on Chosŏn scholars.

2. Western Science and the Intensification of the *I-Ching*-based Cosmology and

Kim Sŏk-mun's (1658-1735) cosmological discussion differed from previous ones in two aspects. First, from the mid-17th century to the early 18th century, the period during which Kim lived and studied, the understanding and dissemination of the *I-Ching* system reached an unprecedented degree. Although *Xing Li Da Quan (Collected Works of Philosophers of the Neo-Confucian School)* did not receive much attention in 17th- and 18th-century Korean academia due to Chosŏn scholars' strong bias for Zhu Xi's Neo-Confucianism, some scholars nevertheless continued to study *I-Ching*-based yi xue, which Zhu Xi himself had emphasized, in relation to the classic text *I-Ching (Book of Changes)*. As a result, studies on the *I-Ching* system, which in the early 17th century had been limited to several ch'immnyudae haksa intellectuals living in Seoul and to Chŏng Ku's

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10 The cosmology of Sŏ Kyŏng-dŏk and Chang Hyŏn-gwang may be cited as representative examples. For a detailed discussion of their cosmology, Moon Joong-Yang, "16·17segı Chosŏn Uchuron-m Sang'suhakch'og Sŏng'gyŏk (The Neo-Confucian Cosmology Associated with the *I-Ching* system in the sixteenth and seventeenth-Century Korea)," *Yeksa Wa Hyŏnsil (Quarterly Review of Korean History)* 34(1999), pp 95-124

11 See Yu Pong-hak, *Yŏnam Ilp' a Pukhak Sasang Yŏr'gyu (A Study of the Northern Learning Philosophy of the *Yŏnam* School)* (Seoul Ilchi-sa, 1995), p 84
and Chang Hyŏn-gwang's disciples, grew in quality and quantity. Moreover, in this period, not only scholars of the Southern Faction but also those of the Old Doctrine and of the Young Doctrine, who in the early 17th century had maintained a critical stance toward the Southern Faction's study of the I-Ching system, all produced noteworthy studies on the I-Ching system. Consequently, not only a full understanding but even a critique of the I-Ching-based yi xue of the Shao Yong School would now have become possible for some Korean intellectuals Kim Sŏk-mun in fact was one such scholar.

Another factor that set apart Kim’s cosmological discussion from foregoing ones lay in the introduction of Western scientific knowledge into Korea and its influence, both direct and indirect, on Chosŏn scholars. As is well-known, the influx of Western scientific knowledge into 17th-century Chosŏn continued ever since Yi Kwang-jŏng first introduced the six-scroll Ou Luo Ba Guo Yu Di Tu (Map of European Nations) in 1603 and Chŏng Tu-won obtained Western science books and equipments from Lu Ruo-han (Johanes Rodriquez) in 1631. Whereas Roman Catholicism (“Western Learning”) had little influence on 17th-century Chosŏn society, world maps and books on astronomy had a considerable impact on Chosŏn intellectuals. In particular,

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12 To date, there seems to be no in-depth study on the development of the I-Ching system in Chosŏn. However, “Yŏkkkyŏng-p’yon (Chapters on the I-Ching)” (37 fascicles) in Han’guk Kyŏnhak Charyo Chupsŏng (Compendium of Data and Materials on the Study of Confucian Classics in Korea) (1996), compiled and published by the Institute of Oriental Culture at Sung Kyun Kwan University, is useful as a sourcebook of historical documents on I-Ching-based yi xue. According to this book, historical documents on the I-Ching system were scarce up to the 16th century but began to increase in the 17th century, reaching their peak in the period stretching from the late 17th century to the early 18th century. Noticeable researches on yi xue were conducted, in particular, by the following figures Han Yŏ-yu (韩汝愈, 1642-1709), Pak Kwang-il (朴光一, 1655-1723), and Kim Sŏk-mun of the Old Doctrine, Yi Hyŏng-sang (李衡相, 1653-1733), Yi Man-bu (李萬敷, 1664-1732), and Chŏng Yong-jin (鄭榮振, 1673-1728) of the Southern Faction, and Ch’oe Sŏk-ch’ŏng (崔錫鼎, 1646-1715) and Chŏng Che-du (鄭齊斗, 1649-1736) of the Young Doctrine.
world maps made Chosŏn scholars realize that China was not the center of the world and thus provided them with an expanded awareness of the world. In addition, the fact that the acceptance of Western astronomical-calendrical science, which had begun in 1644 when Kim Yuk, then a supervisor of the Royal Astronomical Observatory, had urged the adoption of the Shi Xian Calendar, was actively implemented by the Korean government over a relatively short period may be seen as another significant factor conducive to changes in Chosŏn intellectuals' traditional cosmology. In other words, with the official adoption of a calendrical system based on Western astronomy by the Korean government, Chosŏn intellectuals came to acknowledge that Western astronomical knowledge was superior to traditional knowledge of calendrical calculations, a realization that eventually was to lead to the replacement of traditional theories by theories based on Western astronomy, at least with respect to cosmic structure and the regularities underlying astronomical phenomena.

These two seemingly contradictory streams of thought simultaneously appeared in Kim Sŏk-mun. Let us then first examine aspects of Western astronomy that Kim incorporated into his own cosmology. He adopted various aspects of Western astronomy such as the arrangement and orbits of the heavenly bodies as well as the fact that the earth is spherical. As Figure 1 shows, the universe consisted

13. As for a discussion on the impact that Western world maps had on changes in Chosŏn scholars' awareness of the world, see Pae U-sŏng, Chosŏn Hugi Kakt'ogwan-gwa Ch'ŏnhagwan-ga Pyŏkwa (Changes in the View on National Territory and the World During the Late Chosŏn Dynasty) (Seoul Ilch'usa, 1998), pp 374-82

14. In fact, the spherical theory seems to have been more or less accepted as fact among Chosŏn scholars ever since Kim Man-jung (金高增, 1637-92) first acknowledged it in his Sŏp'o Manp'il (Kim Man-jung's Essays) Regarding this fact, see Kang Chae-ŏn (姜在沅), Chosŏn-ja Sŏlaksa (The History of Roman Catholicism in Korea) (Seoul Minŭmsa, 1990), p 34; Kim
of nine spheres in Kim's theory—di lun tian, yue lun tian, ri lun tian (tai yang tai bai chen xing tian), ying huo tian, sui xing tian, zhen xing tian, heng xing tian, tai xu tian, and tai ji tian. Because they revolve around the sun, Venus and Mercury do not form independent spheres and thus have been included in ri lun tian. Solely in terms of its external structure, Kim's schematization of the heavenly bodies is strikingly similar to that of Tycho Brache save for the fact that, here, all spheres beyond heng xing tian—zong dong tian (primum mobile), dong xi sui cha tian, nan bei sui cha tian, and chang jing tian (static sphere)—have been completely excluded and replaced by the more traditional tai xu tian and tai ji tian. In Kim's

Sökg-mun himself was one such scholar. As for his argument that the earth was circular, see Yŏkkhak Isipsa Tohac, p. 32.a (pagination here follows that used in the photoprint copy originally published in Tongbanghakpo 16 (1975)).
theory, the center of the heavenly bodies was not the earth but tian xin (zenith), which meant that all heavenly bodies and spheres including the earth revolved around tian xin, the cosmic center. Such placement of tian xin, and not the earth, in the center of the universe coincides with Ptolemy's eccentric theory. In addition, Kim's classification of the fixed stars and the sizes of the Seven Luminaries (Seven Regulars) into six categories and calculations of the sizes reflect the contents of Matteo Ricci's *Gan Kun Ti Yi* (Cosmological Epitome; 1605).\(^{15}\) This knowledge of the exact sizes of the heavenly bodies and the classification of the fixed stars was made available to Chosön intellectuals for the first time with the introduction of Western astronomical data into Korea.

All such Western astronomical knowledge that Kim Sŏk-mun accepted reflects the major contents of *Wu Wei Li Zhi* (Calendarical Record on the Five Planets; 1634). Considering the fact that his *Yŏkhak Tohae* (Diagrams of Yi Xue)\(^{16}\) was written in the late 17th century and that the whole cosmological discussion in the work comes not from a calendrical scientist but from a Confucian scholar,\(^{17}\) Kim displays remarkable accuracy and academic level in delineating his astro-

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15 In other words, the size of the earth was 38 $\frac{1}{3}$ times that of the moon, 2,1951 times that of Mercury, 36 1/27 times that of Venus, the size of the sun was 165 $\frac{1}{3}$ times that of the earth, that of Mars was $\frac{1}{2}$ that of the earth, that of Jupiter was 94 $\frac{1}{2}$ times that of the earth, and that of Saturn was 90 $\frac{1}{3}$ times that of the earth. See *Yŏkhak Isypsa Tohae*, pp. 30a-b

16 *Yŏkhak Tohae*, which Kim penned around 1697, was to be popularized through *Yŏkhak Isypsa Tohae*, published around 1726. Although the two works were almost identical in content, *Yŏkhak Isypsa Tohae* included some supplementary explanation as it had been revised for publication. Strictly speaking, Kim’s cosmology therefore may be said to represent the cosmological knowledge that was prevalent in Korea in the late 17th century.

17 Following *Wu Wei Li Zhi*, even more advanced accomplishments in astronomy were to be found in Mei Wen-dung’s (梅文鼎) *Li Xue Yi Wen* (Queries on Calendarical Science, 1693) and Mei Gu-cheng’s (梅光鼎) *Li Xiang Kao Cheng* (Compendium of Calendarical Science and Astronomy [Compiled by Imperial Order], 1722), both of which were introduced into Chosön after 1725.
nomical knowledge. In particular, ever since its treatment in Johann Adam Schall von Bell's Yuan Jing Shuo (Monograph on the Telescope, 1626) and subsequent in-depth discussion in Wu Wei Li Zhu (1634), the Tychonic system came to be known as the most reliable cosmic system.  

Further analysis of Kim Sŏk-mun's theory on the structures and motion of the heavenly bodies, however, 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. Instead, his ideas on the generation, motion, and termination of the universe depended wholly on the metaphysical principle of generation initiated by Zhou Dun-yi's concept of t'ai ji (Supreme Ultimate) and on the principle of cosmic configuration as the fundamental nature of shu (numbers), the concept espoused by the Shao Yong School. Kim therefore attached less importance to the process of physical generation initiated by qi (material force) that fills Zhang Zai's (Zhangzi's) concept of t'ai xu (Great Void) than to the principles of t'ai ji and shu.

For Kim Sŏk-mun, t'ai ji denotes the essence predating the generation of heaven and earth, a state of absolute inertia and silence where distinctions such as clarity/turbidity, motion/inertia, inside/outside, bigness/smallness, and change/rupture do not exist. According to him, it was in this t'ai ji that t'ai xu was generated. How then could the slight motion of t'ai xu be generated from t'ai ji, which

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18 As for detailed discussions on the process through which the Tychonic system came to be disseminated and known in China, see, among others, Keizo Hashimoto, Hsu Kuang-Chu and Astronomical Reform The Process of the Chinese Acceptance of Western Astronomy 1629-1635 (Kansai UP, 1988), pp 74-163, Nathan Sivin, "Copernicus in China," Studia Copernicana 6 (1973) 63-122, and Wang Ping (王行), Hsi Fang Li Suan Hseuh Chih Shu Ju (The Introduction of Western Astronomical-Calendrical Science) (Taipei, 1966), pp 6-45

19 Yŏkhak Iupsa Tohae, p 37 b
supposedly denotes a state of absolute inertia and silence? Kim explained this apparent contradiction with the logic of ti-yong (essence-function). Tai ji was li (original principle) and within li was ti-yong. In other words, the inertia of tai ji was ti and its motion was yong. Moreover, because quiescence is a premonition of motion, one can understand this to mean that inertia is already pregnant with motion. It thus becomes possible for the slightly moving tai xu, which is yong, to be generated from the inert tai ji, which is ti.20 This was what Zhou Dun-yi had signified when he had said “tai ji’s motion yet generates yang (太極動而生陽).”21 Once the slightly moving tai xu is generated, it in turn generates heng xing tian, which is faster than tai xu itself, and then generates the even faster zhen xing tian. Generated in this manner, spheres closer to the inner core of tai xu are faster, culminating in the fastest-moving earth, which is generated in the innermost core of tai xu. Such a correlation between the speed of the motion of spheres and their later generation, closer to the core of tai xu, likewise reflects Zhou’s statement, “motion occurs in tai ji and yet is quiescent (動極而靜).” This statement meant that tai ji generates the slightly moving tai xu, which in turn generates spheres faster than itself, thus generating faster spheres as the process of generation proceeded.22

20 Yǒnhak Isupsa Tohac, p 36 b

21 Yǒnhak Isupsa Tohac, 36 a Here, Kim adds the following explanation what he calls “tai ji’s motion (太極動)” does not signify the motion of tai ji itself but that of qi within tai ji, and tai ji is located in the center of such qi. Through such explanation, Kim seems to propose the concept of qi within tai ji as the basis or starting point of physical generation because he saw the metaphysical process of generation alone as inadequate. Here, we witness Zhang Zai’s qi and Zhou Dun-yi’s tai ji, or the difficulty of the synthesis of li.

22 Here, Kim once again adds an explanation This was because the statement “motion occurs in tai ji and yet is quiescent” could be misconstrued to signify that quiescence lay at the end. He explains this statement thus Because the earth empirically seemed to be inert, people said “motion occurs in tai ji and yet is quiescent” without knowing that it was the
On the other hand, Kim Sŏk-mun also explains this generation and structure of heaven and earth as the fundamental nature of shu. According to him, the quiescent (i.e., tai yi) has no shu because shu starts from extremely slight motion. This is none other than the number 1, or slight motion Consequently, tai ji, the essence, has no shu as it is inert, and the slightly moving tai xu is the beginning of shu, or 1. The number 1 therefore is the slight motion of tai xu, and the place where this motion occurs is called 1 xu. This 1 xu is the beginning of shu, which begets all numbers and material phenomena. For Kim, this shu or number called 1 xu was the origin of motion and therefore the smallest unit of motion, tai xu tian being the unit of diurnal motion.

In addition, xu was zhou tian xu shu, the smallest unit of zhou tian du shu. Starting from du, Kim Sŏk-mun divided the angular units of the circle into sixty units and further classified them into the nine stages of (du)-fen-miao-wei-xian-hu-mang-chen-ai-xu. As a result, if 1 xu, as the unit of tai xu tian’s diurnal motion, were zhou tian xu shu, then zhou tian ri shu, or the number of days it took tai xu tian to complete one revolution around zhou tian, would be calculated as \(60^9 \times 360\) days. And, according to Kim’s calculation, the number of years it took for one revolution was 9933,1611, 2839,5980 years. Going even beyond, he calculated the diameter and

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fastest heavenly body. Such explanation, however, does not seem to be logical. In other words, did Kim mean that Zhou Dun-yi had said, “motion occurs in tai yi and yet is quiescent” to express people’s general misconception of the earth as inert?

23 See Yiŏhak Isupsa Tohae, p 35 b

24 Presented in Taegok Yiŏhak Tohae from fascicle 10 of “Yŏkkyöng-p’yon,” Han’guk Kyöngchog Charyo Chapsöng, pp 495-96, this differs slightly in Yiŏhak Isupsa Tohae, p 35 b. In both accounts, however, the classification into nine stages from du to xu is identical.

25 In other words, the result would be \(60^9 \times 360 = 362,7970,5600,0000,0000\) days.

26 Yiŏhak Isupsa Tohae, p 36 b This figure is obtained by dividing zhou tian ri shu by sui
the length of the circumference of tai xu tian. These he obtained by establishing the distance of 1 xu, or the unit of tai xu tian’s diurnal motion, and 90,000 li, or the distance travelled by the earth in one day, as identical. Consequently, the circumference of tai xu could be obtained through the equation “zhou tian ri shu of tai xu × 90,000 li,” and tai xu’s diameter could be calculated by dividing its circumference by π. Kim thus determined the circumference of tai xu tian as approximately $3.265 \times 10^{23}$ li (Chinese mile) and its diameter as approximately $1.139 \times 10^{23}$ li. In this way, he went on to calculate the orbital radii of all heavenly bodies.

Following Kim’s logic, however, we come across a problem. In order for his calculations to be convincing, their hypotheses or premises would first have to be clarified. Why must the unit of tai xu tian’s diurnal motion be 1 xu? Why is the distance of 1 xu (and the distance travelled by all other heavenly bodies in one day) identical with the distance that the earth travels in one day, or 90,000 li? Kim demonstrates why 1 xu becomes the unit of tai xu’s diurnal motion in the following manner: He compares the motion of tai xu tian and di lun tian, both generated by the inert tai ji tian, to the rotation of the sphere called the earth, whose center is di xin. Although di xin itself is inert, any spot even slightly beyond di xin starts to move slightly, reaching the highest speed on di lun (i.e., surface of the earth). Because di xin is inert, it can be compared to the inert tai ji. Just as tai ji, while inert in itself, is pregnant with the

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27 Yŏkch’ok Yŏkhak Tohae, p. 30a

28 All of them are $(9,0000 \times \text{zhou tian ri shu}) - 2\pi$. As for the orbital radii of the heavenly bodies that Kim obtained, see Yŏkch’ok Yŏkhak Tohae, pp. 31a-b
slightly moving t'ai xū and, by extension, with the motion of all heavenly bodies generated by t'ai xū, the inert di xīn likewise is pregnant not only with 1, the beginning of motion, but also with the motion of all spots and locations away from di xīn, including the 90,000-li motion of the surface of the earth. Seen thus, the motion of the number 1, which is the first thing apart from di xīn and which therefore can be seen as the origin of motion, and the diurnal 90,000-li motion of the surface of the earth, which is furthest removed from di xīn and hence the fastest, in fact occur at the same time. In other words, when the surface of the earth moves 90,000 li in one day, the spot closest to di xīn moves 1 in one day. And this entire process can be applied to the motion of the heavenly bodies. As the statement “the inertia of di xīn is the tī of and the motion of di lún is the yòng of t'ai xū” shows, 1 xu, or the motion of t'ai xū which slightly moves 1 once it breaks out from the inert t'ai jì, turns out to be identical with the diurnal 90,000-li motion of the earth, the fastest heavenly body.29 By the same logic, the diurnal motion of other spheres can be said to equal the earth’s diurnal 90,000-li motion.

Such “verification” by Kim Sŏk-mun is logically difficult for us moderns to understand and accept. For Kim himself, however, there seems to have been no logical gap in his argument. Likewise, we can question his division of t'ou t'ien du shū into sixty units, further classification of the sixty units into nine stages—starting from du and ending with xu—and use of these divisions and classifications to calculate the t'ou t'ien ni shū of t'ai xū. Why, then, did he propose nine stages? Instead of classifying the sixty units into nine stages and then making xu the smallest unit, he probably established xu and du first and, on the basis of certain criteria, further divided the sixty

29 As for Kim’s demonstrations and verifications, see Taegok Yeokhak Tohae, pp 495-96
units into nine stages. The criteria or the grounds here may very well lie in the fundamental nature of the number 9. Indeed, the number 9 appears frequently in Kim's theory on cosmic structure and motion. There are nine spheres in the heavens and nine strata from the underground to the atmosphere, and the earth moves 90,000 li in one day. If so, then it would have been perfectly natural for zhou tian du to be classified into nine stages. The problem here lies, however, in the fact that what divided zhou tian du shu into nine stages was not a physical entity. For Kim, there was no distinction between physical entity and mathematical tools. Consequently, he simply applied zhou tian du shu, which he had divided into nine stages mathematically, to calculate the revolution cycle (i.e., zhou tian ri shu) of the heavenly bodies, or physical entities.

Such demonstrations and calculations on the part of Kim Sŏk-mun can be seen as the product of typically I-Ching-based ideas, which obtained the revolution of the heavenly bodies, or physical entities, on the basis of the non-material metaphysical principle derived from tai ji and the fundamental nature of shu. The richness of Kim's I-Ching-based imagination was such that it could very well surpass the cosmological discussion of Shao Yong, who had claimed that the generation and termination of the universe were brought about by the epoch coincidence cycle. In Shao's theory, cosmic cycles were classified thus: 30 years equalled 1 shi, 12 shi equalled 1 yun, 30 yun equalled 1 hui, and 12 hui equalled 1 yuan. Moreover, during 1 yuan (1 yuan = 30 × 12 × 30 × 12 = 12,9600 years), the opening, closing, generation, and termination of the universe supposedly occurred. In other words, these cosmic cycles were not inferred from the physical entity of the heavenly bodies and the motion and change of all

30 Beginning with (hidden) fire (暗火) underground, the nine strata include earth, stone, water, wind, cold vapor, hot vapor, night, and day. See Taegok Yŏkkhak Tohne, pp 503-4
material phenomena but logically derived from the fundamental nature of numerical units of time. What Kim did was to go beyond even Shao himself and to calculate anew the cycles of the opening and closing of the universe on the basis of the regularity of and changes in the physical motion of the heavenly bodies.31

Kim based his cosmic cycles on precession, which denotes the yearly westward movement of the nodal point, where the ecliptic and the equator meet, that occurs in accordance with changes in the axis of the earth. He understood this to mean that, when the paths of the sun and the earth intersect at two points respectively in the east and the west at an oblique angle, the earth goes around the sun one time by moving eastward along the north-south axis of the path of the sun. In other words, when the earth moves eastward from the western nodal point in the northern part of the path of the sun and reaches the northernmost point, sunlight is at its maximum, thus causing all material phenomena to flourish. This Kim saw as the first phase of the opening of all material phenomena. When the earth again moves eastward and reaches the eastern nodal point, it is the first phase of the closing of all material phenomena. This entire period is 1 hui, which may be called one mini-cycle of opening and closing and ⅓ of the precession cycle. When the earth again moves eastward from the southern part of the path of the sun and reaches the southernmost point, it is the second phase of the opening of all material phenomena. When the earth once again moves eastward and reaches the western nodal point, it is yet another—the second—phase of the closing of all material phenomena. This entire period is 2 hui and the earth has completed one revolution.32 In other words, such

31 As for Kim's discussion, see also Chön Yong-hun, op cit (1997), pp 139-40
32 See Taegok Yŏkkuk Tŏhac, pp 516-7
single revolution by the earth was the period of precession, which
Kim determined as 2,5440 years.33 Seen thus, 1 hui equals 1,2720
years, which is different from Shao Yong’s 1,0800 years. The 2,5440
years here, however are not a unit of one grand opening but only
amount to a small-scale cycle of opening and closing (i.e., 2 hui).
Such cycles of opening and closing, measurable in units of hui, thus
form the cycle of one grand opening and closing. Kim derived this
principle in turn from the changes in the obliquity of the paths of
the sun and the earth, or in the way the obliquity of the ecliptic and
the equator changed from 0° to 45°. When the obliquity reaches 45°,
it is the period of one grand opening; conversely, when the obliquity
reaches 0°, it is the period of one grand closing. The amount of
time needed for the completion of one such cycle is 60 hui, or the
time it takes the earth to travel its path 30 times, which turns out to
be 76,3200 years. This figure, which was the true 1 yuan for Kim,
was over 6 times greater than Shao’s 1 yuan (= 12,9600 years).34
However, Kim’s cycle of cosmic revolution did not end here. He in
fact went on to imagine an overwhelming cosmic cycle by squaring 1
yuan three times, which yielded a period amounting to 8 squares of
76,3200 years.35

Kim Sŏk-mun’s task of thus deriving cosmic cycles from the motion
of the heavenly bodies can clearly be said to be original. Never-
theless, it would be difficult to see such derivations as having gone
beyond metaphysical rationality and developed into “structural

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33 After comparing and verifying figures from the Shou Shi Calendar and the Shi Xian Calendar, Kim eventually used Shao Yong’s method of variation (一元消長之四甲子法) to derive the figure of 2,5440 years. See Yŏkhan Isipsa Tohne, p 36 b
34 See Taegok Yŏkhan Tohne, pp 518-20
35 This is approximately 1,1151 × 1048 years. See Taegok Yŏkhan Tohne, pp 521-3
rationality." They should be viewed not as having overcome and departed from the I-Ching-based concept, or the concept that the process of cosmic generation and termination was based on the fundamental nature of shu, but rather should rightly be understood as having intensified and extended I-Ching-based concepts by specifically applying the motion of the heavenly bodies, in terms of spatial structure, to more complex and mathematical cosmic cycles. In the end, with the influx of more precise and rational Western astronomical knowledge into Korea, Kim, who accepted and adopted it, can be said to have attempted a resolution of the discrepancy between this newly obtained knowledge and traditional I-Ching-based epistemological system through an intensification of the I-Ching system.

3. An Extreme Development of I-Ching-based Cosmology

The two factors behind Kim Sŏk-mun’s I-Ching-based cosmology, which had been the intensification of the I-Ching-based epistemological system in Chosŏn academia and the influence of Western science, exerted an even stronger influence on Sŏ Myŏng-ŭng (1716-1787), who lived and studied from the mid- to the late 18th century. First, let us examine the fact that the I-Ching system increased in importance in 18th-century Chosŏn academia following Kim’s era, which can be judged from academic trends among scholars of the Capital School. In other words, Kim Ch’ang-hŭp encouraged

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36 For instance, in his thesis (1997), pp 140-1. Chŏn Yong-hun thus prases Kim’s achievement “Kim Sŏk-mun was a pioneer who, going beyond the metaphysical rationality of Neo-Confucianism, established a new brand of yì xue that explained the generation, motion, change, and termination of the universe with ‘structural rationality.’”
Kim Sŏk-mun, one of his disciples, to study I-Ching-based yi xue. Esteeming highly Kim Sŏk-mun's research, Kim Won-haeng likewise encouraged his disciples such as Hwang Yun-sŏk (1729-1791) to study the I-Ching system even further. Although it took a second place to the study of righteousness in the theory of propriety and to the theory of mind-nature, the I-Ching system nevertheless came to receive increasing attention from scholars of the Capital School throughout the 18th century because it provided these scholars with some theoretical basis in their debate on the theory of identicalness and difference in the nature of man and beasts, or the so-called Kiho School-Capital School Debate. Nor would such a situation have been limited solely to scholars of the Capital School. Indeed, when we consider the historical fact that later scholars of the Capital School played a central role in the formation of the Northern Learning School (Economic Enrichment School), which was to lead Chosŏn academia in subsequent years, the significance of the I-Ching system in Chosŏn academia cannot be bypassed. Although, as a scholar of the Young Doctrine and therefore unaffiliated with the academic tradition of the Capital School, Sŏ Myŏng-ŭng nevertheless was a figure who maintained close academic ties with scholars of the Capital School-Northern Learning School who were based in Seoul.

On the other hand, by virtue of his status as an official academician, Sŏ Myŏng-ŭng was placed at the center of an environment that could provide him with access to a wealth of the latest information on Western scientific knowledge. He succeeded in securing stable government posts under the reigns of Kings Yongjo and Chŏngjo and, in particular, enjoyed authority as a scholar who had served as a taejehak (munhyŏng). After the establishment and emergence of the

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37 As for a discussion on I-Chung-based trends within scholars of the Capital School, see Yu Pong-hak, op cit (1995), pp 82-4
Royal Library and Archives as the center of academic activities under the reign of King Chŏngjo, Sŏ played a noteworthy role in this institution by taking charge of various compilation and publication programs.38 Moreover, he had already been to Beijing in his youth (1754) as a sŏjanggwan and had personally experienced Qing China’s advanced civilization. In such a milieu, Myŏng-ŭng, who was at the center of academia, had access to the wealth of the latest information on astronomical mathematics from Qing China above anyone else under the reigns of Kings Yŏngjo and Chŏngjo and, along with his son Ho-su, was thus acknowledged as the foremost astronomical mathematician of the day. Already under the reigns of Kings Yŏngjo and Chŏngjo, Myŏng-ŭng supervised as p’yŏnjip tangsang and Ho-su personally authored as p’yŏnjip nangch’ŏng the chapter “Sang’wigo (Treatise on Astronomy)” in Tongguk Munhŏn Pigo (Reference Compilation of Documents on Korea; 1770), which was a document containing the most advanced astronomical knowledge available that had been officially approved of by the Korean government. Even before this, in 1760, Myŏng-ŭng had realized the imperative need for measurements of polar altitude and thus had requested King Yŏngjo that polar altitude be measured at the magistrate office in each province.39 It was because of such activities and endeavors that Myŏng-ŭng later came to be considered as their mentor by the younger scholars of the Northern Learning School.

Sŏ Myŏng-ŭng’s discussions on the structures, form, and motion of

38 See Kang Sun-ae, “Chŏngjo Kyujanggag-ui Tose P’yŏnch’an Mit Kanhaeng (Compilation and Publication of Books by the Royal Library and Archives Under the Reign of King Chŏngjo),” Kyuنجgak 9 (1985), pp 97-128

39 As for discussions on Sŏ Myŏng-ŭng’s proposal to measure polar altitude under the reign of King Yŏngjo, see Pae U-sŏng, Chosŏn Hagi Kuk’agwan-gwa Ch’ŏnhagwan-ui Pyŏnhwa (1998), pp 386-88
the heavenly bodies are well delineated in his P'uryeun and Sŏng'uye. His astronomical knowledge in these works encompasses comparatively recent data from Găn Kun Ti Yi (1609) to Li Xiang Kao Cheng (1723). What is noteworthy about these books, however, is that Sŏ here adopted the Ptolemaic system (generally known as the "old map"), where all planets supposedly revolved around the earth, instead of the Tycho's cosmic system (usually known as the "new map"), which had come to be accepted by scholars as the more rational theory ever since the publication of Wu Wei Li Zhi (1634). This is odd considering that Li Xiang Kao Cheng, which described astronomical-calendrical science strictly on the basis of Tycho's cosmic system, had already been introduced into Chosŏn in the 1720's and had in turn brought about the publication of Sinsu Sihŏn Ch'ilch'ŏngp'op (Newly Revised Methods for Calculating the Motions of the Seven Luminaries According to the Shi Xian Calendar) in 1725; and, as the examples of chibans'gyŏngch'a and ch'ŏngmonggich'a show, Sŏ was clearly conversant with the latest astronomical knowledge. Moreover, Sŏ did not even mention the theory of the rotation of the earth, which had aroused considerable interest among some Korean scholars since Kim Sŏk-mun's times. How then are we to account for such silence? It is through this question that we can see Kim Sŏk-mun's regressive efforts to fuse advanced, precise astronomical knowledge and the traditional cosmology of Confucianism developing in a more extreme manner in the case of Sŏ Myŏng-ŭng, who sought to intensify and extend the I-Ching-based epistemological system.

40 These books are included in Pomanjue Ch'ungsŏ (Collected Works of Sŏ Myŏng-ŭng) (Kyujanggak Antiq 0270-11), the collection of Sŏ Myŏng-ŭng's works. Among them, books 19 and 20 are P'uryeun and books 21 and 22 are Sŏng'uye.

41 As for a detailed discussion on the contents and source of the astronomical knowledge that Sŏ summarized here, see Pak Kwon-su, op cit (1998), pp 63-74
The I-Ching-based aspect of Sŏ Myŏng-ŭng's cosmology is well delineated in his Sŏnch'ŏn Sayŏn. If Piryejun and Sŏng'uyje had been comprehensive descriptions of astronomical-calendrical knowledge regarding the structure and motion of the heavenly bodies and ways of calculating them, Sŏnch'ŏn Sayŏn was further elaboration of his I-Ching-based system using astronomical-calendrical knowledge. In the latter book, Sŏ interprets astronomical-calendrical knowledge solely and thoroughly through the application of xian tian yi, or the I-Ching-based epistemological system that Shao Yong had revived.

Sŏ's basic framework for understanding nature, or astronomical mathematics and calendrical science, was the xian tian diagram. Xian tian diagrams were illustrations supposedly derived by Fuxi from the he tu (River Diagram), or illustrations of cosmic principles bestowed upon the sage by Heaven. As is evident from the passage "After observing heaven and earth, Fuxi drew the Xian Tian Fang Yuan Tu and from thence inferred the square diagram, created instruments for the kai tian (Covering Sky), and devised the base and altitude method, thus establishing li du," the mythical sage Fuxi supposedly derived the base and altitude gu method, a mathematical method, from the Xian Tian Fang Yuan Tu and in turn derived astronomical-

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42 This work is included in books 1 and 2, once again, of Ponnampae Ch'ongsŏ, which is the collection of his works currently housed in Kyujanggak.

43 Including the Xian Tian Ba Gua Ci Xu Tu, Xian Tian Ba Gua Fang Wei Tu, Xian Tian Liu Shi Si Gua Ci Xu Tu, and Xian Tian Liu Shi Si Gua Fang Yuan Tu, these diagrams originally had been conceptualized by Shao Yong. However, they were first presented as diagrams in Zhu Xi's Zhou Yi Ben Yi (Original Meaning of the Yi Jing, 周易本義). See "Yi Ben Yi Tu (易本義圖)," Zhou Yi Zhuo Yi Da Yuan (周易傳義大全), ed Ming Hu-guang (明胡廣), first fascicle, 1415, p 24, 27, 32, and 37. Sŏ presents countless illustrations including these xian tian diagrams in the卷下 of his Sŏnch'ŏn Sayŏn. Among these, the Xian Tian Liu Shi Si Gua Fang Yuan Tu, usually referred to as "Xian Tian Fang Yuan Tu," is the most important one.

44 "Piryejun-sŏ (Preface)," Piryejun, p 1
calendrical science, which calculates the motion of the heavenly bodies, from the base and altitude method. In other words, as is evident from the passage “the mysterious motion and changes of all material phenomena and wise conduct all come from the Xian Tian Fang Yuan Tu, be they small or large, be they refined or coarse. Would it then not be so in the great task establishing li du?” So’s entire thought regarding the I-Ching system converged to the single diagram called the Xian Tian Fang Yuan Tu. Consequently, in his view, the Xian Tian Fang Yuan Tu had to be accountable for all principles and rules of the motion of the heavenly bodies.

Thus based on the principles of the Xian Tian Fang Yuan Tu, So sought to explain all possible astronomical-calendrical knowledge.46

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46. For a detailed discussion on So’s I-Ching-based yi xue and its application to interpret astronomical-calendrical science in his Sŏnch’ŏn Sayŏn, see Pak Kwon-su, op. cit. (1998), pp. 74-89.
Representative astronomical knowledge that he attempted to account for with the principles of the *Xian Tian Fang Yuan Tu* includes the circular shape of the earth, the ninefold structure of the heavens, the 23.5° slant in the axis of the earth, the westward motion of heaven and the eastward motion of the Seven Luminaries, tong sheng zhi cha⁴⁷, and climatic differences that occur in accordance with the latitude on the globe.

Among these, let us now examine So’s explanation for the westward motion of heaven and the eastward motion of the Seven Luminaries. As the grounds for the westward motion of heaven (or stars) and the eastward motion of the sun and the moon, he pointed to the sequential arrangement of the Sixty-four Hexagrams in the circular diagram, which is the outer diagram in the *Xian Tian Fang Yuan Tu*.⁴⁸ In other words, in the circular diagram, the hexagrams in the left half of the diagram, from qian (“heaven”) to fu (“return”), are arranged counterclockwise, or in accordance with their sequence in the *Fuxi Liu Shi Si Gua Ci Xu Tu*. However, hexagrams on the right half of the diagram, from gou (“coming to meet”) to kun (“earth”), are arranged clockwise. Interpreting counterclockwise and clockwise directions as the directions of numbers and of their reciprocals, respectively, So claimed that heaven moves westward and the sun and the moon move eastward because of such principle

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⁴⁷ This term designates the difference between 1° in the equator and 1° in the ecliptic. For instance, during winter and summer solstice, 1° in the ecliptic is greater than that in the equator, during vernal and autuminal equinox, however, the latter is greater. Such a phenomenon occurs naturally because the celestial sphere is spherical and because the equator and the ecliptic intersect at an oblique angle. See Maeng Ch’ŏn-sul (孟天旭), trans., *Yŏksŏn Saeroun Haeŏk* (*A New Interpretation of the Principles of the Yung*), pp 89-92; and Pak Kwon-su, op cit (1998), pp 76-78

⁴⁸ See the outer circle in Figure 2 *Fuxi’s Xian Tian Liu Shi Si Gua Fang Yuan Tu*
inherent in the *Xian Tian Fang Yuan Tu*.\(^{49}\)

Of course, such "verification" by Sŏ Myŏng-ŭng may be seen as groundless explanation for the physical phenomena of the westward motion of heaven and the eastward motion of the sun and the moon. Why, for instance, should the direction of the sequential arrangement of hexagrams in the *Xian Tian Fang Yuan Tu* be linked to the direction in which the heavenly bodies move? If the *Xian Tian Fang Yuan Tu* is nothing but a descriptive model of the motion of the heavenly bodies, Sŏ's "verification" can only be sophism. To Sŏ himself, however, the *Xian Tian Fang Yuan Tu* could be used as theoretical grounds because the diagram was natural order itself. In other words, all natural phenomena and changes came about as a result of the essential characteristic of the diagram and, for Sŏ, not only phenomena such as the motion of the heavenly bodies but also shu (numbers) were but derivatives of such diagrams. For instance, even fa shu,\(^{50}\) which explained cosmic cycles as had Shao's theory of epoch coincidence cycle, was no original creation by Shao. Rather, all such had already been inherent in Fuxi's *Xian Tian Fang Yuan Tu* but had not been perceived earlier; it was Shao who had understood and derived these mathematical methods. Sŏ therefore attempted provide in his *Sŏnh'ŏn Sayŏn* the grounds for discussion on the process of cosmic generation based on Shao Yong's theory of epoch coincidence cycle through the *Xian Tian Fang Yuan Tu*, as he likewise did for astronomical-calendrical science.\(^ {51}\)

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\(^{49}\) See "Fang'won Ŭljon Yuk (方園晷域) [Sunsu Yŏksu (曆數表數)]," *Sŏnh'ŏn Sayŏn*, pp 29-33

\(^{50}\) Shao Yong's mathematical methods that Sŏ mentions are the Jing Shu Gua Shu Tu (經世計數圖), Yi Yuan Xiao Chang Tu (一元涓長圖), and Tian Di Shu Zhong Tu (天地始終圖) in the *Huang Ji Jing Shu Shu* (Book of the Sublime Principle which Governs All Things within the World; 輯極經世書)

\(^{51}\) See "Fang'won Su Chŏn Sa (方園數圖)," *Sŏnh'ŏn Sayŏn*, pp 56-7
Because the Xian Tian Fang Yuan Tu existed to explain or to provide the basis for such complex structures and motion of the heavenly bodies, newly introduced Western astronomical knowledge must have been rationally explainable in terms of the diagram. If that was the case for Sŏ, then a structure where only Mercury and Venus revolve around the sun and the rest of the heavenly bodies revolve around the earth would have been difficult to explain through his Xian Tian Fang Yuan Tu. Or else, if he had to resort to extremely complicated calculations in order to explain such a structure, the calculations need not have been so complicated after all. This does not mean, however, that Sŏ denied the validity of all existing astronomical-calendrical knowledge which could not be explained through the Xian Tian Fang Yuan Tu. In the case of astronomical knowledge that had already been acknowledged as obvious facts and truths, he in fact adjusted and revised the Xian Tian Fang Yuan Tu.

Such a revision of the Xian Tian Fang Yuan Tu was closely related to the theory of the circular earth. For Sŏ, Western astronomical knowledge that the earth was spherical was an obvious truth. Experience proved it: for every 250 li that one travelled on the surface of the earth, polar altitude changed by 1°. 52 His grounds for the circularity of the earth, however, lay in the he tu. In other words, the five points in the Central Palace of he tu criss-cross to form shapes made up of three points and, according to Sŏ, it was from these three-pointed shapes that the circularity of the earth had been derived. Misled by the square shape of the inner diagram of the Xian Tian Fang Yuan Tu, however, people earlier had misunderstood the shape of the earth as a square and even Confucians of the day continued to deny the validity of the theory of the circularity of the earth.

52 See "Pang’won Sang Chŏn Ch’i’il (方圖 coh 華七) [Chiwon Chintŏn (地圖真傳)]," Sŏch’ŏn Sayŏn, p. 50 and "Sanghan-je (象限計)," Sŏngju, p. 9
In order to right this discrepancy between the circular form of the earth and the Xian Tian Fang Yuan Tu, Sŏ revised the square diagram by drawing it askew at 45°, so that it would not be a square but a rhombus, thus allowing the diagonals to intersect at right angles.

However, such a revision of the square diagram does not diminish the validity of Sŏ’s argument because the new diagram, now shaped like a rhombus, was in fact more consonant with the shapes formed by the five points in the Central Palace of the he tu. Moreover, no one could be certain as to the authorship of the existing Xian Tian Fang Yuan Tu ascribed to Fuxi because the diagram had first been presented in Zhu Xi’s Zhou Yi Ben Yi (Original Meaning of the Yi Jing). Consequently, it could be argued that people hitherto had mistaken a later version as the true Xian Tian Fang Yuan Tu, or the diagram originally intended by Fuxi. Sŏ thus came to present a new Xian Tian

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53. See “Pang’won Sang Chŏn Ch’ı (Chiwon Chinn’ŏn),” Sŏnech’ŏn Se’yŏn, p. 50.
Figure 4. Sŏ Myŏng-ŭng’s Sŏnch’ŏn Yuksipsa-gwae Pang wondo

Fang Yuan Tu that was more in harmony with the new astronomical knowledge of his own day by revising the diagram that supposedly had been presented by Cai Yuan-ding and Zhu Xi, Song Dynasty Neo-Confucians. As a result, he was able to explain even more astronomical knowledge on the basis of his new Xian Tian Fang Yuan Tu.

This revision reveals two things about Sŏ. First, in order to bridge the discrepancy between the more precise and logical astronomical knowledge of the West and his own I-Ching-based epistemological system, Sŏ intensified and refined the I-Ching-based epistemological system in a more complex manner, as is evident from his Sŏnch’ŏn Sayŏn. This in fact formed a part of the strategy of justification

54. The new Xian Tian Fang Yuan Tu is in “Pang’won Wich’i (方面位置).” Sŏnch’ŏn Sayŏn, fascicle 2.
adopted by Confucians, who had no choice but to acknowledge the superiority of Western astronomy to traditional astronomical-calendrical science and, at the same time, wished to incorporate the new knowledge into their own epistemological systems. Such attempts at justification are most noticeable in the so-called theory of Confucian sages as the originators of astronomy, which appears in the prefaces of Sŏ's most systematic works on astronomy—Sŏn'guje, Pryejun, and Sŏnch'ŏn Sayŏn. According to this theory, Western astronomy and xian tian yi formed a ti-yong relationship. In other words, the ancient base and altitude method, which was yong, and astronomical-calendrical science had been ideal because they had included xian tian yi, which was ti. Because the base and altitude method and calendrical science had been transmitted to the West and subsequently been reintroduced into China after the ancient era, Western astronomy was yong in relation to xian tian yi, which was ti. On the basis of such concepts, Sŏ criticized Western astronomy thus: Although mathematically superior, Western astronomy can only explain the superficies and not the essence because it lacks xian tian yi, which is ti. In the end, the task that Sŏ set himself to accomplish was to intensify superior Western astronomy by providing it with xian tian yi, its roots as well as ti; hence his three books on astronomy.

The second fact that is noticeable about Sŏ's revision of the Xian Tian Fang Yuan Tu is that the Xian Tian Fang Yuan Tu, which up to then had been accepted by Confucians as indubitable truth, now actually came to be revised. Although, of course, it was not difficult to find Confucians who denounced xian tian diagrams and the

55 For a detailed account, see Pak Kwon-su, op cit (1998), pp 89-94
56 For this discussion, see "Sŏn'guje-sŏ," Sŏn'guje, pp 1-2
I-Ching system themselves in Chuna\textsuperscript{57}, no major movement doubting the genuineness of xian tian diagrams emerged up to the 18th century in Chosön academia. Sŏ's revision of the Xian Tian Fang Yuan Tu, however, could serve as an occasion for the destruction of the belief in the absoluteness of xian tian diagrams. In particular, we must not overlook the fact that, in revising the xian tian diagram, Sŏ clearly realized the obvious truth of Western scientific knowledge and the basis of such scientific knowledge on superior mathematics. In other words, because sophisticated and rational astronomical theories continued to emerge, Confucians consequently sought for I-Ching-based systems that could match such theories. In the process of this pursuit, these scholars attempted to devise even more intensified but revised I-Ching systems. Such continued change, however, in the end could very well lead to doubts over the diagram itself, previously believed as absolute truth. Moreover, a development in that direction could bring about a recognition of the historicity of xian tian diagrams. By realizing the incorrectness of the Xian Tian Fang Yuan Tu as it had been presented by Cai Yuan-ding and Zhu Xi, Sŏ could arrive at a realization of the historicity of the Xian Tian Fang Yuan Tu itself.

\textsuperscript{57} This tendency was quite pronounced in Chinese academia of the Ming and Qing Dynasties. For instance, Huang Zong-xi (黄宗羲; 1610-95), Mao Qi-heng (毛奇齡, 1623-1716), and Hu Wei (胡渭, 1633-1714) categorized Shao Yong’s xian tian yi as nothing more than Daoist magic and therefore irrelevant to the essentials of Confucianism and denied any link between Fuxi and xian tian diagrams, which they saw as pure fabrication. Such po xue yi (朴學易), on the other hand, was one level above the new I-Ching system as represented by Jiao Xun (焦循, 1761-1802). Regarding these discussions, see Lào Meng-chun (廖名春), Kang Xue-wei (康學偉), and Liang Wei-xuan (梁韋炫), Ch’ŏk Ch’ŏl-haksu (A History of the I-Chung Philosophy), trans Sim Kyŏng-ho (Seoul Yemun Sŏwon, 1994), pp 569-707
4. The Emergence of an Anti-I-Ching-based Understanding of Nature

In earlier sections of this thesis, we examined the process through which the I-Ching-based aspect was intensified in the cosmological discussions of Kim Sŏk-mun of the early 18th century and Sŏ Myŏng-ŭng of the mid- and late 18th centuries. What is noteworthy about such intensification of the I-Ching-based epistemological system, however, is that it occurred simultaneously with the introduction of and under the influence of Western scientific knowledge in Chosŏn academia. In particular, the fact that such development took place alongside the realization that Western scientific knowledge was superior, sophisticated, and rational is even more significant. Thus awareness of the superiority of Western science and in-depth understanding of astronomical-calendrical science itself thus would serve as an occasion not only for fortifying the I-Ching system but also for overcoming, or even negating, traditional epistemological system.

Although he was aware of the superiority of Western astronomy above anyone else and therefore went on to revise the Xian Tian Fang Yuan Tu in reaction, Sŏ did not in the end question I-Ching-based images such as the xian tian diagram. In other fields, however, we discover signs of dissent against traditional epistemological systems. This is true of the Ponsa (Main History; ca. 1785), which is included in Pomanjae Ch’ongsŏ, the collection of Sŏ’s works. A practical and comprehensive treatise on agriculture that adopted and synthesized the relatively more advanced agricultural knowledge of China, the Ponsa was the first agricultural treatise of Chosŏn to analyze and summarize the advanced irrigation techniques of the West that had
originally appeared in *Tai Xi Shui Fa* (*Western Irrigation Techniques*). Judging Western irrigation techniques, which were based on the base and altitude method, to be superior to traditional irrigation techniques, Sŏ sought in this work to introduce advanced irrigation techniques to Korea.\(^{58}\)

In light of this, it is interesting that, in stating the purpose of writing his *Ponsa* in the epilogue of the work, Sŏ Myŏng-ŭng, who thus admitted and claimed the superiority of Western irrigation techniques, mentioned the proverbial anecdote of Zigong from *Zhuangzi* but interpreted it in a manner completely opposite from the received interpretation. Originally, the proverbial anecdote had Zigong teach a peasant how to use the well sweep, a more effective irrigative tool for drawing water, only to be rebuffed because, according to the peasant who in fact already knew how to use the well sweep, it was not the way (道) and mere clever dealing (事). This proverbial anecdote reflects the traditional, naturalistic view of agriculture and irrigation that artificial tools such as the well sweep, although convenient and efficient, do not embody the way of nature and therefore are not worth using, and even goes on to criticize Zigong for advocating the use of such artificial tools. No doubt, such naturalistic views on agricultural technology would have been well established among Chosŏn intellectuals also. Sŏ, however, boldly refused such traditional concepts to be found in *Zhuangzi*—i. e., the traditional concept that man must obey the way of nature—and highly esteemed Zigong as a Confucian who had taught the peasant\(^{58}\)

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\(^{58}\) As for discussions on Sŏ's analysis and summary of advanced irrigation techniques focusing on Western irrigation techniques, in his *Ponsa*, see Moon Joong-yang, “18segi Chosŏn Sunhag-ta T'onggang-gwa Kŭ Ch'uu (The Emergence of the Hydro-Agricultural Science in the 8th-Century Korea),” *Han'guk Sasaeng Sahak (The Study of Korean History of Thoughts)* 9 (1997), pp 176-96
how to use the artificial tool called the well sweep.59

While we find no negation of traditional I-Ching-based concepts and systems in Sŏ Myŏng-ŭng, we do so in his son Sŏ Ho-su (1738-1799), who undoubtedly learned much from and was greatly influenced by his father. Ho-su would have continued the academic tendencies of Myŏng-ŭng; he did in fact personally proofread his father’s works before publishing the m.60 Moreover, the younger Sŏ was acknowledged as the foremost astronomical-calendrical scientist in late 18th-century Chosŏn so as to be entrusted with the task of compiling and editing all government publications on astronomical-calendrical science including the “Sang’wigo” chapter in Tongguk Munhŏn Pigo and Kukcho Yŏksanggo (National Treatise on Astronomy and Calendrical Science) and, throughout the reign of King Chŏngjo, served as a supervisor of the Royal Astronomical Observatory. Considering such an illustrious record, it is all the more noteworthy to find the following passage in Ho-su’s answer to Weng Fang-gang’s question during the former’s trip to Beijing in 1790 as the vice-minister of an embassy of gratitude to China.

Western astronomical-calendrical methods are extremely different from [our] ancient methods. The Tai Chu Calendar of the Han Dynasty generated shu from huang zhong (fundamental pitch) and the Da Yan Calendar of the Tang Dynasty generated shu from shi ce, which are ways of deriving calendrical methods from yi (changes). Although the principles of yue (music) and li (calendars) and of yi and li generally are not unrelated, they should never be yoked together in order to mislead, as their methods are extremely different from one another.61

59. For a discussion on Sŏ’s stance that criticized the traditional naturalistic view of irrigation and defended the “artificial” view of irrigation, see Moon Joong-yang, “Chosŏn Hugi-ui Sŭch’ŏ (Water Mills During the Late Chosŏn Dynasty),” Han’guk Munhwŏ (Korean Culture) 15 (1994), pp. 261-2

60. Sŏ Ho-su also proofread Sŏnch’ŏn Sayŏn, Sŏ Myŏng-ŭng’ important work on the I-Chung system.

61. From the entry for 25th day of the month Gui You (癸酉), Yŏnhaenggi (Record of an Embassy to Beijing, 燕行記), fascicle 3 (Kyujanggak 4907)
The passage above shows that Ho-su, like Myŏng-ŭng himself, saw the principles of li and yi as equal. The younger Sŏ, however, dissented from his father by viewing the methods of li and yi as very different. Sŏ Ho-su therefore went on to evaluate the Tai Chu and Da Yan Calendars in a critical manner, claiming that it was illogical to derive li from yi. Western astronomical-calendrical methods, on the other hand, were, in his view, without such logical fallacy. The passage above then may be understood to mean that, while acknowledging the fundamental aspect of yi as a principle, Ho-su thought that applying this principle of yi to the actual motion of the heavenly bodies was a completely different matter. In other words, he accepted the fundamental aspect of Myŏng-ŭng’s Xun Tian Fang Yuan Tu as a principle but refused to apply the diagram to astronomy. Such ideas held by Ho-su, however, did not develop apart from his father’s work but were in fact its extension.

On the other hand, we find a categorical denial of traditional I-Ching-based system of understanding nature in Hong Tae-yong (1731-1783), who studied at Sŏksil Private Confucian Academy under Kim Won-haeng, the head of the Capital School who had also fostered Kim Sŏk-mun, and was known for his expertise in the I-Ching system and astronomical-calendrical science along with his peers such as Hwang Yun-sŏk and Chŏng Ch’ŏl-cho.

Unlike the case of Kim Sŏk-mun and Sŏ Myŏng-ŭng, Hong’s cosmology basically started from Zhang Zai’s theory of qi and was different from the concept of cosmic cycles based on Shao’s xian tian yi or the metaphysical process of generation initiated within Zhou Dun-yi’s tai ji. Hong described the generation of heaven and earth thus “The only thing filling the vast tai xu was qi; there were no distinctions such as inside/outside or beginning/ending. After accumulating infinitely, this qi eventually coagulated to form zhi
(material forms), which revolve around the void or rotate while stationary in the center. These forms are none other than the earth, sun, moon, and stars."62 This obviously is a wholesale adoption of the process of physical generation initiated by Zhang Zai's qi. Moreover, Hong adjusted Tycho Brahe's cosmic structure to Zhang's cosmology. In other words, the sun and the moon revolved around the circular earth and the rest of the planets revolved around the sun in his cosmic structure.63

Hong's cosmology, however, did not remain on the level of the Tychonic system, which would have been a combination of Zhang's traditional cosmology and the medieval cosmology of the West.64 Going even further, he claimed that the circular earth, instead of being stationary in the center of the solar system, floated amid the void and rotated once each day, with all material phenomena attached to its surface.65 How then could the massive earth possibly float amid the void? And, even if it did turn on its axis, how could man and all material phenomena on its surface stand without falling, considering the great velocity of the earth's rotation? In responding to such questions, Hong used his rich imagination and cited, as his answer, the shang xia zhī shì of the qi surrounding the earth.66 Moreover, he did not stop here but went on to argue that, considering the infinitude of the universe, the earth must not be in the center. In other words, although the earth was located in the

62 "Naejip Poyu (內集補遺)." Taehönsa (湛軒書), in fascicle 4 of the Öisan Mundap, p. 19 a
63 See ibid., pp. 22 b-23 a. That Hong Tae-yong's cosmic structure was identical with the Tychonic system is apparent also from his Chuhae Suyong (補解盈用)
64 "Medieval" here means that the Tychonic system stipulates the concepts of a finite universe and of the stationary position of the earth in the center of the universe.
65 See ibid., p. 19 a
66 See ibid., pp. 20 a-b
center of the Seven Luminaries, or the solar system, it would not be so when seen from outside the solar system because the stars there would then be in the center. This may be understood as Hong’s presentation of a relative concept of central position in the infinite universe.67

What is striking about these arguments regarding the generation, change, structure, and motion of the universe, all from his Čisan Mundap (Dialogue on Mt. Yiwulu), is that there is no mention of the I-Ching system whatsoever. The one time that Hong does mention the I-Ching system is in the statement “When I, after reaching adulthood and going out into the world, attempted to calculate 1 yuan, I could not tell whether it was several thousand, ten thousand, or hundred thousand years,” which shows a clear skepticism of Shao’s “1 yuan = 12,9600 years” as the unit of the opening of heaven and earth.68

Such out-and-out negation of the I-Ching system is even more overt in his Kyemong Kii (Queries on Yi Xue Qi Meng). As its title implies, this work catalogues the questions that Hong had while reading Zhu Xi’s Yi Xue Qi Meng (Introduction to Yi Xue), which synthesizes and summarizes I-Ching-based yi xue of the Song Dynasty on the basis of Shao Yong’s I-Ching system. Throughout his work, however, Hong raises strong questions regarding the specific contents of Yi Xue Qi Meng. First, he questions the received view that the methods of calendrical time-keeping were derived from the circular diagram in the he tu and that the methods of sectioning off the states were

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67 See ibid., p. 22b Such concepts of an infinite universe and of relative space received attention from early on. For a representative discussion, see Park Seong-rae (朴星來), “Han’guk Konse-ri So’gu Kwahak Suyong (The Adoption of Western Science in Early Modern Korea),” Tongbanghak 20 (1978), pp. 272-6. In the thesis just cited, the author highly esteems Hong Tae-yong’s concept of relative space, calling it the theory of multiverse (多世界說).

68. See ibid., pp. 23 a-b
derived from the square diagram in the *Luo Shu* (*Luo River Writings*). Pointing out that such beliefs on the part of Shao and Zhu Xi were but cases of ungrounded assumption, Hong denies the validity of the traditional concept that astronomical-calendrical science and geography had been derived from the he tu and the luo shu.\(^{69}\) In other words, contrary to Sŏ Myŏng-ŭng, who had claimed that ideal astronomical-calendrical science could be inferred from the he tu and xian tian diagrams, Hong opposed the derivation of astronomical-calendrical methods from the he tu and xian tian diagrams altogether. Moreover, he consistently negated all explanations of the *I-Ching* system that made use of complicated mathematical calculations in *Yi Xue Qi Meng* in terms such as “incomprehensible (不可解),” “unclear (未明),” and “not so (然).”\(^{70}\)

The object of Hong’s negation, however, was not limited to such *I-Ching*-based epistemological systems only. Many important aspects of traditional cosmology such as concepts and methods of understanding the generation and change of the cosmos and material phenomena on the basis of yin-yang and the Five Elements (Five Powers), the cosmological view based on the supposed resonance between heaven and the terrestrial realm of man, and the theory of field division too were thoroughly negated.\(^{71}\)

Hong’s negation of yin-yang and the Five Elements stemmed from his discussions on climactic changes on the globe and meteorological changes in a single day. In other words, it was warm in the daytime and hot in summer because there was more sunlight; it was cold in

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\(^{69}\) Fascicle 1, “Naepp (內集),” *Tambónŏ*, in Kyemong Kiŭ, pp 52 a-b.

\(^{70}\) See *ibid.*, pp 53 a-55 a

\(^{71}\) These are what John B Henderson sees as the basic modes of correlative thought, which characterizes the traditional cosmology of China. See John B Henderson, *op cit.*, pp 2-59
the nighttime and winter because there was less sunlight. By thus having Sirong, the fictive speaker of his work, deny any relationship between climactic changes and the operation of yin-yang, Hong negated yin-yang. In addition to this attack on the operations of yin-yang and li-qi, he stressed the fictionality of the Five Elements system. That is, the concept of the Five Elements was but an unorthodox one espoused by fortune-tellers as their principle and forcibly derived from the he tu and the luo shu, and not in line with the regularities underlying material phenomena.\textsuperscript{72}

In addition, Hong specifically pointed out that the Five Elements system was not only unable to account for natural order but also founded on self-contradictory logic. The self-contradictory logic here denotes the error in the sequence of the mutual production of the Five Elements. The generative sequence of the Five Elements, as well-known, is water-fire-wood-metal-earth. According to Hong, however, tai xu is the essence of water, the sun is the essence of fire, and the planet earth, as the residue of water and fire, is the essence of earth. Needless to say, the sun and the earth were generated before all material phenomena, and wood and metal (in addition to water and fire) in turn were generated later through the operation of the sun's fire and the earth's earth.\textsuperscript{73} This is Hong's generative sequence of heaven and earth and all material phenomena. Seen thus, at least the position of earth here differs from that in the generative sequence of the Five Elements. He clearly pointed out this contradiction in his Kyemong Kiû.\textsuperscript{74}

In addition, Hong denies the validity of both the theory of field

\textsuperscript{72} As for Hong Tae-yong's negation of yin-yang and the Five Elements, see fascicle 1, "Naejip," Tamhônsô, in Úsan Mundap, pp 29 a-30 b

\textsuperscript{73} See ibid., p 32 b

\textsuperscript{74} Fascicle 1, "Naejip," Tamhônsô, in Kyemong Kiû, p 52 b
division and the cosmological view based on the supposed resonance between heaven and the terrestrial realm of man. Blaming the fortune-tellers for having founded such an implausible view, he thus criticized the cosmological view that correlated astronomical phenomena with terrestrial ones, or the belief that the fixed stars, as symbols or images of all material phenomena, interacted with and corresponded to the terrestrial realm.

Compared to tai xu, the terrestrial realm is but a speck of mote. Even the territory of China only amounts to a tenth of the entire terrestrial realm. It may make sense to section off the entire surface of the earth and assign each to the longitudes of Lunar Lodges. Otherwise, it is unspeakably vain and foolish to divine disasters and auspices by forcibly assigning the Nine States, which lie on one side of the entire terrestrial realm, to the stars and then conveniently combining or dividing them.75

In other words, it is absurd to predict disasters and auspices regarding matters that take place in the terrestrial Nine States in terms of stars in the sky. Moreover, the Nine States of China are but a part of the globe. The theory of field division therefore is founded on the correlation not between the entire heaven and the entire earth but between the entire heaven and only a part of the earth; hence the absurdity of the whole theory.

It is not clear as to how far such negation of traditional systems of understanding nature, including the I-Ching system, developed in the 19th century following the eras of Sŏ Ho-su and Hong Tae-yong. We do find, however, a further development of Sŏ’s and Hong’s critical and anti-I-Ching-based stance in Chŏng Yak-chŏn (1758-1816), who was a scholar of the Southern Faction with considerable interest in

75 See fascicle 1, “Naeip,” Tántaehānsa, in Ûisan Mundaep, p. 26a
and sympathy for Roman Catholicism and Western science.

Chŏng Yak-chŏn negated the notion that the mathematics in Jiu Zhuang Suan Shu (Nine Chapters on the Mathematical Art) and Zhou Bi Suan Jing (Arithmetic Classic of the Gnomon and the Circular Paths of Heaven) had been derived from the he tu, luo shu, and yi. This viewpoint clearly emerges in his comments on his younger brother Chŏng Yag-yong's study of the I-Ching. That is, while reading a work titled Liang Heng Yi, Yag-yong realized that the practice of equating 16 tael with 1 catty had derived from the rule of doubling the Four Symbols and Eight Trigrams in the I-Ching and therefore told his elder brother Yak-chŏn that mathematics that originated from the I-Ching-based system of the I-Ching. Such a notion, as we have seen clearly in the earlier section of this thesis on Sŏ Myŏng-ŭng, would of course have been obvious to late-Chosŏn Dynasty experts on the I-Ching system Yag-yong's "new" realization thus may be taken to mean that, after beginning an in-depth study of the I-Ching, he had come to realize this notion himself. Yak-chŏn criticized Yag-yong, however, and countered by asking his brother how the rule of doubling the Four Symbols and Eight Trigrams could be seen as "the origin of mathematics" when it was no creation by the sages in the first place but merely a specious trick forged by fortune-tellers in later ages. Moreover, Yak-chŏn pointed out the fact that, because people had come to explain the operation of heaven and earth and li-qi in terms of mathematics only after the emergence of Shao's xian tian diagram, it was wrong to see pre-Shao I-Ching system as the origin of mathematics. 76

76 For Chŏng Yak-chŏn's critical discussions on mathematics and the I-Ching system, see Sonam Sŏdok (Letters of Chŏng Yak-chŏn 孫夢霞信), continuation 4, book 24, in Yŏngdang-jip (Collection of Works by Chŏng Yag-yong, 孫陽澄集) (Kyuwanggak 11894) 13 (pagination follows that of Sonam Sŏdok), or Sŏ Chong-t'ae (徐鍇泰), "Sonam Chŏng Yak-chŏn-t'u Silhak Sasang..."
In the end, these facts reveal that Yak-chŏn understood the mathematics of Zhou Bi Suan Jing and Jiu Zhuang Suan Shu completely apart from I-Ching-based epistemological systems. Such understanding may be said to have stemmed from an awareness of the historicity of Shao’s xian tian diagram. In addition, this can be called a progressive stance that overcame a tradition-bound understanding of nature.

Conclusion

According to foregoing examination of 18th-century Chosŏn intellectuals’ cosmological discussions, the intensification and extension of the I-Ching system within cosmology and the expansion of advanced, precise Western scientific knowledge formed the two axes of 18th-century Chosŏn cosmology. Although different in their respective traditions and contents, however, these two aspects developed not apart from each other but through mutual influence within single cosmology, thus giving birth to even richer—albeit not scientific and rational in the modern sense—cosmology. Kim Sŏk-mun’s cosmology, which is representative of this mixture and coexistence of two sides, reached the height of sophistication by adopting Western astronomical tradition based on precise data and mathematical techniques in addition to strengthened I-Ching-based concepts and refined I-Ching-based epistemological system In other words, two different cosmological traditions combined in a subtle way to form single cosmology.

With a greater influx of information on Western astronomy and an increasing awareness of its superiority to traditional astronomy,

(The Silhak Thought of ‘Sonam’ Chŏng Yak-chŏn),” Tong’a Yŏn’gu (Journal of East Asian Studies) 24 (1992), pp 271-311 and, in particular, pp 289-91
however, this aspect of Kim's cosmology of the early 18th century developed in two extreme directions in the mid- and late 18th centuries and onwards. One of the subsequent tendencies, which is evident in the case of Sŏ Myŏng-ŭng, was to redefine and readjust all astronomical-calendrical knowledge in terms of the I-Ching system (xian tian yi). Indeed, Sŏ went so far as to define astronomical-calendrical science and the I-Ching system respectively as ti and yong and to claim that the perfection of ancient astronomical-calendrical science could be reattained only by supplementing contemporary mathematics and astronomical-calendrical science, which were but yong, with xian tian yi, which was ti. Cosmological discussions in this vein subsequently developed so as to exclude completely the traditional theory of the qi-initiated physical generation of the cosmos that had dominated the cosmological discussions of Chosŏn Confucians from Sŏ Kyŏng-dŏk to Kim Sŏk-mun himself ever since the acceptance and adoption of Song Dynasty Neo-Confucian cosmology in Korea. Eventually, these discussions would develop in the direction of extreme I-Ching-associated cosmology based solely on the xian tian yi system.

It must be kept in mind, however, that such I-Ching-based cosmo-

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77 This designates the qi-monomistic cosmology initiated by Zhang Zai's (1020-1077) cosmology. After presenting tai xu replete with primitive qi as the physical origin of the formation of the cosmos, Zhang Zai's cosmology claimed that voluntary motion inherent in qi brought about the generation, change, and termination of all phenomena in the universe. It was in the context of such cosmological discussions that astronomical-calendrical scientists' theories on the structure of the universe were critically reviewed. Yamada Ken' (山田慶見) claims that this cosmology came to serve as Chinese Confucian intellectuals' dominant cosmology after it had been adopted and redefined by Zhu Xi, the compiler of Neo-Confucianism. In addition, he esteems the fruit of this cosmological view as “a revolution in Song Dynasty Confucianism.” Regarding such discussions, see Yamada Ken, Chusei Chogyonhak (Zhu Xi's Natural Philosophy), trans Kim Sŏk-ŭn (Seoul: T'ongnamu, 1991), pp 33-67.
logical discussions were based on the consensus that Western astronomy was superior in both data and mathematical calculations. Moreover, with the inception of the idea that such superior astronomy and mathematics had actually been derived from Fuxi, the Confucian sage, xian tian yi began to undergo changes in accordance with the new astronomical knowledge. With further continuation of such a trend, the negation of xian tian yi (i.e., I-Ching-based epistemological system) could very well occur within I-Ching-based discussions.

We have already seen the roots of a stance critical of the traditional I-Ching system of understanding nature in So Myong-ung, however vague; his son So Ho-su, on the other hand, advanced a highly developed critique of the I-Ching system. This was the other direction in which the cosmological discussions of the mid- and late 18th centuries developed. Its extreme case is to be found in Hong Tae-yong, who, unlike Myong-ung and Ho-su, both representative official academicians, remained outside academia throughout. Hong categorically negated what Henderson calls correlative thoughts—the cosmological system of I-Ching-based yi xue, understanding of nature based on yin-yang and the Five Elements, and an understanding of the cosmos based on the resonance among heaven, earth, and human society. Of course, such denial would have been a very exceptional case in late 18th-century Choson academia. What must be noted here, however, is the fact that a stance such as Hong's had the potential to emerge even in the extreme I-Ching system of So Myong-ung mentioned above.

In addition, Chong Yak-chon, a Silhak scholar of the Southern Faction who lived and studied in the late 18th and early 19th centuries, even went on to deny any link between the I-Ching system and mathematics whatsoever. This negation may be seen as having opened up the possibility of seeing astronomical-calandrical science purely in quantitative terms and on the basis of geometric methods, completely severed from the I-Ching system.
Glossary

chiban’gyŏngch’a 지반경차
ch’öngmunggich’a 청몽기차
absolute mertia and silence 寂然不動
at 块
base and altitude method 勾股法
Cai Yuan-ding 蔡元定
calendarical time-keeping 禪紀
Capital School 洛論
catty 斤
Central Palace 中宮
Chang Hoe-ik 張會翼
Chang Hyŏn-gwang 張顯光
chang jing tian [static sphere] 常靜天
Che 1 Chŏkkŏk Kuch’on Pudo 『第二赤極九天附圖』
chen 塵
ch’imnyudae haksa 枕流臺學士
Chŏng Ch’ol-cho 鄭品祚
Chŏng Ku 鄭逵
Chŏng Tu-won 鄭斗源
Chŏng Yag-yong 丁若鏞
Chŏng Yak-chŏn 丁若铨
Chosŏn (Dynasty) 朝鮮(王朝)
circular diagram 圓圖
closing (of all material phenomena) 閉物 [閉塞, 閉閉]
Confucianism 儒學 [儒家]
Da Yan Calendar 大衍曆
di lun 地輪
di lun tian 地輪天
di xin [center of the earth] 地心
dong xi sui cha tian 東西隕差天
du 度
earth 土
eastward motion 右行
eccentric theory 異心軌度理論
ecliptic 黃道
Eight Trigrams 八卦
vice-minister of an embassy of gratitude to China 謝恩副使
equator 赤道
fa shu 法數
fen 分
fire 火
Five Elements [Five Powers]
五行 [五德]
Five Planets [Mars, Mercury, Jupiter, Venus, Saturn]
五星 [火星, 水星, 木星, 金星, 土星]
fortune-teller 術數家
Four Symbols 四象
Fuxi [Baoxi] 伏羲 [包羲; 胞羲]
Fuxi Liu Shi Si Gua Ci Xu Tu 伏羲六十四卦次序圖
Gan Kun Ti Yi [Cosmological Epitome] 乾坤體義
generative sequence 生序
grand closing (of all material phenomena) 大閉塞
grand opening (of all material phenomena) 大開闢
grand opening and closing (of all material phenomena) 人開閉
Han (Dynasty) 漢(代)
he tu [River Diagram] 河圖
heng xing tian 恒星天
hexagram fu ["return"] 復卦
hexagram gou ["coming to meet"] 婦卦
hexagram kun ["earth"] 坤卦
hexagram qian ["heaven"] 乾卦
Hong Tae-yong 洪大容
hu 忽
huang zhong [fundamental pitch] 黃鐘
hui 會
Hwang Yun-sok 黃胤錫
I-Ching [Zhou Yi; Book of Changes] 『易經』[『周易』]
I-Ching system 象數學
inertia 不動
inner diagram 內圖
Jiu Zhuang Suan Shu [Jiu Zhuang Suan Jing; Nine Chapters on the Mathematical Art] 九章算術
Johann Adam Schall von Bell [Tang Ruowang] 湯若望
Kai Tian [Covering Sky] 盖天
Kiho School-Capital School
Debate 濟洛 論爭
Kim Ch’ang-hup 金昌藩
Kim Sŏk-mun 金錫文
Kim Won-haeng 金元行
Kim Yuk 金旭
King Chŏngjo 止袞
King Yongjo 英祖
Kukcho Yŏksanggo [National Treatise on Astronomy and Calendrical Science] 『國朝曆象考』
Kyemong Kŭti [Queries on Yi Xue Qi Meng] 『啓蒙記疑』
li [calendar] 厲
li ["Chinese mile"] 里
li [original principle] 理
li du 厲度
li-qí 理氣
Luang Heng Yi 『星術議』
longitudes of Lunar Lodges 宿度
Lu Ruo-han (Johannes Rodriuez)
陸若漢
Luo Shu [Luo River Writings]
『洛書』
magistrate office 監營
mang 棒
Matteo Ricci [Li Ma-dou] 利瑪竇
Mercury 辰星 [水星]
metal 金
miao 秒
Ming (Dynasty) 明(代)
motion 動
mutual production 相生
nan ben sui cha tian 南北都差天
Neo-Confucianism 性理學 [新儒學; 新儒家]
"new map" 新圖
Nicholas Copernicus 歌白尼
[歌白尼; 谷白尼; 泥谷老]
Nine States 九州
runefold heavens 九重天
Northern Learning School [Economic Enrichment School]
北學派 [利用厚生學派]
Ogawa Haruhisa 小川晴久
Old Doctrine 老論
"old map" 古圖
opening (of all material phenomena) 開物 [開關]
opening and closing (of all material phenomena) 開閉
Ou Luo Ba Guo Yu Di Tu [Map of European Nations]
『歐羅巴國舆地圖』
outer diagram 外圖
path of the earth 地道
path of the sun 日道
Piryejun 『聘禮準』
Pomanyae Ch'ongsŏ [Collected Works of So Myŏng-ŭng]
『保晉齋叢書』
Ponsa [Main History] 『本史』
precession 周差 運動
Ptolemy 多祿迣
p'yŏnjip nangch'ong 編輯郎廳
p'yŏnjip tangsang 編輯堂上
qi [material force] 氣
(Qin Ding) Li Xiang Kao Cheng [Compendium of Calendaric Science and Astronomy (Compiled by Imperial Order)] 『(欽定)曆象考成』
Qing (Dynasty) 清(代)
quiescence 靜
residue 儲存
resonance (between heaven and man) (天人)感應
According to the Shu Xian Calendar 『新修時憲七政法』
Sirong 實翁
Sixty-four Hexagrams 六十四卦
slight motion 微動
Sŏ Ho-su 徐浩修
Sŏ Kyŏng-dŏk 徐敬德
Sŏ Myŏng-ŭng 徐命膺
sŏjanggwan 室狀官
Sŏksil Private Confucian Academy 石宰書院
Sŏch’on Sayŏn 『先天四演』
Sŏn’chŏn Yulsapsa-gwae Pang’wondo 『先天六十四卦方圖』
Song (Dynasty) 宋(代)
Sŏn’guje 『南極』
Southern Faction 南人
square diagram 力圖
study of righteousness 義理學
sui xing tian 歲星天
supervisor of the Royal Astronomical Observatory 觀象監 提調
symbol [image] 象
taejehak [munhyŏng] 人提學 [文衡]
tael 兩
Tai Chu Calendar 太初曆
tai ji [Supreme Ultimate] 太極
tai ji tian 太極天

Tai Xi Shui Fa [Western Irrigation Techniques]

太虛 [Great Void]

太虛天

Tang (Dynasty) 唐(代)

terrestrial realm 地界

(theory of) epoch coincidence cycle 元會運世(說)

theory of field division 分野說

theory of identicalness and difference in the nature of man and beasts 人物性同異論

theory of mind-nature 心性論

theory of propriety 禮論

theory of qi 氣論

theory of the circularity of the earth 地圖說

theory of the rotation of the earth 地轉說

ti-yong [essence-function] 體用

tian xin [zenith] 天心

tong sheng zhu cha 同升之差

Tongguk Munhön Pigo [Reference Compilation of Documents on Korea] 『東國文獻備考』

Tycho Brahe 的谷 [第谷]

Ulsan Mundap [Dialogue on Mt Yuwul tü] 『簸山問答』

Venus 太白 [金星]

Wang Xi-chan 王錫閔

water 水

water sweep 桀槔

wei 微

Wen Fang-gang 翁方綱

westward motion 左旋

wood 木

Wu Wei Li Zhu [Calendrical Record on the Five Planets]

『五綸圖志』

xian 纜

xian tian diagram 先天圖

Xian Tian (Liu Shi Si Gua) Fang Yuan Tu 『先天(六十四卦)方圓圖』

xian tian yi 先天易

Xing Li Da Quan [Collected Works of Philosophers of the Neo-Confucian School]

『性理大全』

xu 虛

yi [change] 易

Yi Kwang-dong 李光庭

yi xue 易學

Yi Xue Qi Meng [Introduction to Yi Xue] 『易學啓蒙』

Yi Yong-bom 李龍範

ym-yang 陰陽

ying huo tian 燦惑天
Yǒkhak Tohae [Diagrams of Yi Xue] 『易學圖解』
Young Doctrine 少論
yuan 元
Yuan Jing Shuo [Monograph on the Telescope] 『遠鏡說』
yue [music] 樂
yue lun tian 月輪天
yun 運
Zhang Zai [Zhangzi] 張載 [張子]
zheng xing tian 鎮星天
zhi [material forms] 質
Zhou Bi Suan Jing [Arithmetic Classic of the Gnomon and the Circular Paths of Heaven] 『周髀算經』

Zhou Dun-yi 周敦頤
zhou tian du 周天度
zhou tian du shu 周天度數
zhou tian ri shu 周天日數
zhou tian xu shu 周天歲數
Zhou Yi Ben Yi [Original Meaning of the Yi Jing]
『周易本義』
Zhu Xi [Zhuzi] 朱熹 [朱子]
Zhuangzi 『莊子』
Zigong 子貞
zong dong tian [primum mobile] 宗動天