

# 2015 International Symposium on Historical Astronomy

September 23 ~ 24, 2015 / KIAS, SEOUL, KOREA

召南天文學史研究所  
SohNam Institute for History of Astronomy

KASI Korea Astronomy and  
Space Science Institute

KIAS 高等科學院  
KOREA INSTITUTE FOR  
ADVANCED STUDY

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Astronomical instruments of the Junghuidang Hall : Anemoscope (相風竿, 風旗), Sundial platform (日影臺), Armillary sphere (渾天儀), Rain gauge (測雨器)  
Background : The 249<sup>th</sup> National Treasure of South Korea – Donggwo-do (東闕圖, Painting of Eastern Palaces), Stored in Korea University Museum.

# 2015 International Symposium on Historical Astronomy

<b>Organization</b>	SohNam Institute for History of Astronomy (召南天文學史研究所) Korea Astronomy and Space Science Institute (韓國天文研究院) Korea Institute for Advanced Study (高等科學院)
<b>Date</b>	September 23~24, 2015
<b>Place</b>	KIAS, Seoul, Korea

# Wednesday 23 September

08 : 30 - 09 : 05 Registration / Tea & Sandwich

## Commemorative Ceremony of the 10th Anniversary of SohNam Institute of History of Astronomy

09 : 05 - 09 : 25 Commemorative address for the 10th anniversary of SIHA

**Yong Bok Lee**  
Director, SIHA

09 : 25 - 09 : 45 Congratulatory address

**Seung Soo Hong**  
Professor, SNU/ Former Director, SIHA

09 : 45 - 10 : 05 Ten years of SohNam Institute of History of Astronomy

**Changbom Park**  
KIAS/SIHA

10 : 05 - 10 : 20 Tea break

## Symposium

10 : 20 - 10 : 25 Opening Remark

**Chul-Sung Choi**  
KASI

## Morning Session

Oral presentations in English

10 : 25 - 11 : 00 Cosmic model and music in ancient China

**Anjing Qu**  
Northwest Univ.

11 : 05 - 11 : 40 When and where were the observations made for the celestial map in the Kitora Tumulus?

**Mitsuru Sôma**  
NAOJ

11 : 45 - 12 : 20 Dispatch of Lee Soon-Ji and Kim Dam as a Seasonal Envoy to Beijing and Scientific Exchange on Calendar-making

**Moon-Hyon Nam**  
Konkuk Univ./Jagyeongnu Research Institute

12 : 25 - 12 : 35 Group Photo

12 : 35 - 13 : 45 Lunch

## Afternoon Session I

Oral presentations in English

13 : 45 - 14 : 20 On the eclipse of 延鳥郎 and 細鳥女 in Samguk-Yusa

**Kiyotaka Tanikawa and Mitsuru Sôma**  
NAOJ

14 : 25 - 15 : 00 Collective properties of Japanese historical eclipse records/ The SN type of SN1604

**Changbom Park**  
KIAS/ SIHA

15 : 05 - 15 : 35 A Study on the Four-Stage Inflow Clepsydra System

**Seon Young Ham**  
Chungbuk Univ./KASI  
**Sang Hyuk Kim, Yong Sam Lee**

15 : 40 - 15 : 55 Tea break

## Afternoon Session II

## Oral presentations in English

15 : 55 - 16 : 30 The Modern Origin of History of Korean Science: Wada Yuji's Study on Korean Traditional Meteorology

**Takuya Miyagawa**  
Japan Society for the Promotion of Science

16 : 35 - 17 : 05 Video Clip Production of Ganui, the Royal Observatory in Joseon Dynasty

**Min-Soo Lee**  
Chungbuk Univ.  
**Yong Sam Lee, Sang Hyuk Kim, Junhyeok Jeon**

17 : 10 - 17 : 40 Study on the Sunrise and Sunset times of the Chiljeongsan- Naepyeon

**Goeun Choi**  
UST/KASI  
**Ki-Won Lee, Byeong-Hee Mihn, Young Sook Ahn**

17 : 45 - 20 : 00 Banquet

# Thursday 24 September

08 : 30 - 09 : 00 Tea & Sandwich

## Morning Session

## Oral presentations in Korean

09 : 00 - 09 : 30 Variation of solar activity and atmospheric change recorded in Korean chronicles during the last millennium

**Hong-Jin Yang**  
KASI/SIHA  
**Junhyeok Jeon**

09 : 35 - 10 : 05 Understanding Hwang Yun-seok's astrological knowledge through Sangwijiyo (象緯指要, Xiang-wei-zhi-yao)

**Mhan-ock Koo**  
Kyunghee Univ.

10 : 10 - 10 : 40 Model study for water wheel control system of Heumgyeonggaknu

**Sang Hyuk Kim**  
KASI/UST/SIHA  
**Seon Young Ham, Yong Sam Lee**

10 : 45 - 11 : 00 Tea break

11 : 00 - 11 : 30 The Direction system of traditional rites and its relation with equinoxes and solstices: A focus on 『Shàngshū(尙書)』 『Yáodiǎn(堯典)』

**Hyun Joo Ji**  
SNU/Kyujanggak

11 : 35 - 12 : 05 Closing remark

**Changbom Park**  
KIAS/ SIHA

# | Abstracts |



# Cosmic model and music in ancient China

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## Abstract

It is often said, in a Chinese classic text, that there is a certain relationship between a cosmic model and music. But one never finds any explicit description on this matter, where does the relationship come from? what is it, and why is it? As a preliminary study on the Beida Bamboo slips of the Qin dynasty, Lu Jiuci asked Chen Qi for mathematics 鲁久次问数于陈起, this talk will reconstruct his triple-square and triple-circle cosmic model according to Chen Qi's words. In particular, we fix the ratios among these squares and circles. Interesting is that these ratios identify a mathematical link between the cosmic model given by Chen Qi and Chinese music system, the five-tone cadence temperament (three scale fall and rise method) 五度相生率(三分损益法). This is the first concrete evidence of historical materials in ancient China we have found which helps us to reveal the relationship by number between a cosmic model and music.

# **Estimating the year and place of observations for the celestial map in the Kitora Tumulus**

**Sôma Mitsuru**

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## **Abstract**

Kitora Tumulus, located in Asuka, Nara Prefecture in Western Japan, is a small circular tomb with a diameter of about 14 meters. It is thought to have been built in the period between the end of the 7<sup>th</sup> century and the beginning of the 8<sup>th</sup> century. A celestial map was found on the ceiling of the stone chamber in the tumulus. On the celestial map more than 350 stars are drawn and they are categorized into more than 74 constellations. The celestial equator and 2 other concentric circles representing the areas of the circumpolar stars and non-circumpolar stars are shown on the map. Although the stars were not accurately located on the map in general, it was found highly probable that the positions of 5 stars near the celestial equator and 6 stars near one of the concentric circles were correctly drawn with respect to the circles and from them the observation year and the latitude of the observation place of the original drawing of the map were obtained as AD 300±90 and 33°.9±0°.7, respectively. The latitude is very close to those of the old Chinese capitals Chang'an and Luoyang.

# Dispatch of Lee Soon-Ji and Kim Dam as a Seasonal Envoy to Beijing and the Scientific Exchange on Calendar-making

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## Abstract

According to the prefaces of the Chapter 156 of the *Annals of Sejong*, the Standards of the Great Concordance system (太陰太陽通軌, Pacing the Motions of the Moon and the Sun) and the Computational Methods of the Muslim Astronomy (*Huihui-lifa*, 回回曆法) were acquired from Ming. And these were used to compile *Inner Volume of the Calculation on the Celestial Motion of Seven Regulators Calendars* (*Chiljeong-san Naepyeon*, 七政算內篇) and the *Outer Volume of the Calculation on the Celestial Motion of Seven Regulators Calendars* (*Chiljeongsan-Oepyeon*, 七政算外篇), respectively. The chroniclers of the *Annals* didn't mention on the collector and date of information acquisitions from Ming, to state *in recent years* only, as well as the list of materials obtained in detail. However, we have more detailed information to make up above prefaces: Postfaces of the Pacing of Motions of Four Virtual (Hidden) Stars (四餘纏度通軌拔文) written by Lee Soon-ji(李純之) and Kim Dam(金淡) after the compilation of the *Chiljeong-san Nae-Oepyeon* in 1444. Most of the Chinese calendrical publications made during the 1380's -1430's at the Astro-calendric Bureau of Ming had been corrected and compiled by Lee Soon-ji and Kim Dam around 1442. It arises doubts naturally, "How was it possible to acquire Chinese treasured calendrical publications?" Further, all the corrected version of the Chinese publications had been printed out at Seoul in 1444, the most of them are preserved intact until today at the former Royal Library and Institution of Learning (Kyujang-gak, 奎章閣) in Seoul. However, there have been arguments on the transmission of the *Huihui-lifa* into Korean peninsula as well as comparative studies among Mashyk's *Huihui-lifa*, *Chiljeongsan-Oepyeon*, Bei Lin's *Qizheng Tuibu* (七政推步), and Treatise on Astrology in the History of Ming (明史曆志) versions.

In this paper, to answer arguments and mystery-like doubts on the Chinese calendar-making source information, the scientific activities of Lee Soon-Ji and Kim Dam as a Seasonal Envoy to Beijing during two months in 1441 were investigated by bibliographic analysis of major historical literatures and contemporary research. From the thirteenth century onwards, the diplomatic contacts between Yuan China and Goryeo Korea were very close and there were frequent exchanges of science information as well as Imperial bestowment of book to Goryeo kings as well as Joseon kings by Ming emperors later. These conventional cultural exchanges provided momentums for the scientists of Sejong's court to make native calendars latitude of Seoul-fitted calendars consequently.

# On the eclipse of 延鳥郎 and 細鳥女 in *Samguk Yusa*

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## Abstract

*Samguk Yusa*(三國遺事, Memorabilia of the Three Kingdom, ca. 1282--1289 ) has been compiled by Iryon (一然) and his disciple Hon'gu (混丘). It contains anecdotes from Korean native and local lore. Among others, there are several anecdotes which relate the connections between ancient Korea and Japan. All of these anecdotes are extremely interesting in historical sense. The authors are most interested in the anecdote of 延鳥郎 and 細鳥女 in view of astronomy. The light of the Sun and moon was lost after this couple had gone to ancient Japan (倭). The authors interpret the event as the total solar eclipse. According to the description of *Samguk Yusa*, it is the eclipse on July 13, AD 158. However, some historians argue that the Korean ancient time scale is enlarged to the past, which means the anecdote of 延鳥郎 and 細鳥女 maybe not as old as AD 158. The authors following the idea of a Japanese historian who proposes the concrete enlargement years of the ancient Korean dating look for the relevant solar eclipse. One candidate is the eclipse on September 5, AD 248. The authors discuss the implication in selecting candidate eclipses. In short, the event in *Samguk yusa* can be used to determine the range of the value of Delta T. .

# Collective Properties of the Japanese Historical Eclipse Records/ The SN Type of SN1604

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## **Abstract**

The Japanese solar eclipse records are taken from Japanese history books covering from 628 to 1800, and their collective properties are studied. The fraction of correct records corresponding to actual events and the degree of concentration of moon's shadow are calculated as a function of time. A series of the eclipse maps averaged over consecutive 30 eclipses are used to find the location of the maximum magnitude of eclipse, and the locations are compared with the central Japan. It is found that the collective properties of eclipse records are strongly correlated with the political situation in Japan.

We compile 103 historical records in *Seonjo Sillok* (The Annals of the *Joseon* Dynasty) associated with SN1604 or Kepler's supernova and combine them with 27 European records to constrain its supernova type. It is found that SN1604 is most likely to be a Type Ib/c supernova according to the light curve reconstructed from the historical data.

# A Study on the Four-Stage Inflow Clepsydra System

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## Abstract

*Heumgyeonggaknu*, (欽敬閣漏) was an automatic astronomical clock made by Jang Yeong-sil (蔣英實) in 1438, and it moved with the power of water-hammering type. It was powered by 2-stage clepsydra with the function of overflow in *Heumgyeonggaknu*. To understand its power, we studied its physical properties and process of development. The first record of clepsydra in Korea was found in *Samguksagi* (三國史記). There was a record that the clepsydra was firstly made in the 17th year of King *Sungduk* (718). This clepsydra was guessed as 4-stage inflow clepsydra (四級補償型浮箭漏) which was usually used in *Tang* dynasty. With 4-stage inflow clepsydra, regular amount of water was filled at *Susuho* from 4 *Pasuhos*, and regular time was measured. In this study, 4-stage inflow clepsydra was designed and made as experimental apparatus in real. The size of *Pasuhos* (water supply jar) with 4-stage was 350(L)×275(W)×150(H)mm and the size of *Susuho* (jar for running water) was 320(L)×320(W)×375(H) mm. The weight of buoy was 2,292g. The experiment was carried out by changing the height of *Pasuhos*'s water supply, initial condition of *Susuho*, and diameter of flow tube. Through the result of this experiment, the properties of 4-stage inflow clepsydra could be understood.

# **The Modern Origin of History of Korean Science: Wada Yuji's Study on Korean Traditional Meteorology**

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## **Abstract**

This paper examines the beginning of historical research on Korean traditional science and its influence both upon Japanese and Korean scholars in the colonial and postcolonial period. In the early twentieth century, Wada Yuji (和田雄治, 1859-1918), the first chief director of the meteorological network in colonial Korea, 'discovered' and carried out historical research on the old meteorological records edited by Chosŏn dynasty. In a series of publications in 1910s, the very first writings on history of Korean science, Wada expressed generous praise for Chosŏn's well-organized rainfall observation system and a century-long record that could not find anywhere in the world. Wada thought such valuation was possible only by those who fully understood the significance of the legacy of the previous dynasty, and it was because he believed he was obligated to speak for the 'uncivilized' Korean who he assumed were incapable of studying their own history. Moreover, his imperial vision was embodied in his historiography that decontextualized history of meteorology from the historical background of Chosŏn. It resulted in Korean meteorology being converged to history of Japanese empire in his description. Not surprisingly, Japanese meteorologists and Korean intellectuals accepted Wada's achievement in different ways. This paper also analyses how Japanese and Korean scholars responded to Wada respectively, and examines the meaning of the imperial legacy in historical study of Korean science.

# Video Clip production of Ganui-dae, the Royal Observatory in Joseon Dynasty

Lee Min Soo<sup>1</sup>, Kim Sang Hyuk<sup>2,3</sup>, Junhyeok Jeon<sup>1,2</sup>, Lee Yong Sam<sup>1</sup>

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## Abstract

The *Ganui-dae* which was built in King *Sejong* Era of *Joseon* Dynasty is the key facility of astronomical observation system. The *Ganui-dae* project was a government major state project which was manufactured several astronomical instruments and astronomical clocks including *Ganui* and *Borugak Jagyeongnu*. This enterprise project shows a high standard of science and technology at that time. However, this highly significant astronomical heritage and science and technology heritage is still unknown to public. We collected and analyzed the previous studies of *Ganui-dae* project and carried out the further studies of *Honcheonui* and working mechanism of water-striking *Honui-Honsang*. We produced the video clip of *Ganui-dae* project for education and information based on the result of this studies.

# Study on the sunrise and sunset times of the *Chiljeongsan-Naepyeon*

Choi Goeun<sup>1,2</sup>, Lee Ki-Won<sup>3</sup>, Mihn Byeong-Hee<sup>1,2,4</sup>, Ahn Young Sook<sup>2</sup>

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## Abstract

We investigate the sunrise and sunset times recorded on the *Chiljeongsan-Naepyeon* (Calculation of the Motions of Seven Governors-Inner Part; hereafter, *Naepyeon*) of the Joseon dynasty in Korea in order to estimate the latitude used in calculating those times. Compiled by Yi, Sunji and Kim, Dam in 1444, the calendar is also included in the *Joseonwangjosillok* (Annals of the Joseon Dynasty). However, the *Naepyeon* contains no detailed explanations of how the sunrise and sunset times were obtained. Instead, it simply mentions that those times were determined by measuring the difference between the shadow lengths of the sun at Hanyang (i.e., Seoul) on the winter and summer solstices. Therefore, we assume that the *Naepyeon*'s sunrise and sunset times were determined in line with the *Datong* calendar of the Ming dynasty in China, because we know that the two calendars are fundamentally the same. For various latitudes, we calculate the sunrise and sunset times in accordance with the calculation methods utilized in the *Datong* calendar and compare the results with those of the *Naepyeon*. We find that the latitude of approximately 38.13 degrees (in units of the Chinese degree) shows the smallest difference in the value of the root mean square. This latitude is similar to 38.16 degrees, to which Yi, Sunji and Kim, Seokje referred in the *Gyosikchubobeop* (Guide to the Calculation of the Dates of Solar and Lunar Eclipses) published in 1458. In conclusion, this study contributes to understanding the features of sunrise and sunset times of the *Naepyeon*.

# Variation of solar activity and atmospheric change recorded in Korean chronicles during the last millennium

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## Abstract

Korea has a long history in astronomy, which is proved by many observational records written in Korean chronicles. There are 43 sunspot records in *Goryeo* dynasty (高麗, 918-1392) and 13 records in *Joseon* dynasty (朝鮮, 1392-1910). According to analysis of Korean historical records, it is known that sunspot records in *Goryeo* dynasty show well in match with the well-known solar activity of 11.3 years. It means that Korean historical sunspot records show real solar phenomena. Korean sunspot records also show that solar activity decrease in *Joseon* dynasty compared with the previous ~500 years. In order to know the change of solar activity in detail, we examine Korean historical atmospheric records which can indicate climate change. We first analyze historical frost records. Korean chronicles have around 600 frost records during the last millennium. We find that the climate change shows sign of cooling down when check the variation of epoch that the first and last frost events in each year are written. This result is well in accord with that of historical sunspot records. Therefore, we claim that solar activity decrease during the last thousand years.

# Understanding Hwang Yun-seok(黃胤錫)'s astrological knowledge through *Sangwijiyo*(象緯指要, *Xiang-wei-zhi-yao*)

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## **Abstract**

Hwang Yun-seok compiled *Sangwijiyo* (象緯指要, *Xiang-wei-zhi-yao*) in the age of 26 in 1754. This astrological book revised and supplemented *Cheonmunryucho* (天文類抄: Selected and classified writings on astrology, *Tianwenleichao*), which was written in the early 15<sup>th</sup> century under King *Sejong*. Originally, *Cheonmunryucho* accumulated information on various portents and mutual stimulation of heaven and earth, with a close relationship with traditional Zai-yi theory(災異說, portentology). However, the traditional Zai-yi theory met challenges from the introduction of new astronomical knowledge from the West in the later *Joseon* dynasty. Reflecting these societal changes, *Sangwijiyo* intended to reorganize traditional astrology using new information and establish Confucian political ideology through the *li* of heaven(天理, *tian-li*). In compiling *Sangwijiyo*, Hwang changed the contents of *Cheonmunryucho*, as well as creating an individual volume of *Bocheonga* (步天歌: Song of the Sky Pacers). Also, he corrected some of numbers and degrees of the constellations conforming to the western astronomy. Hwang also positively adopted newly popularized theory of “*donggukbunya* (東國分野: allocated fields of Korea, *dongguofenye*)” and assigned prefectures and counties (郡縣) of the entire Joseon to the lunar mansions(twenty-eight mansions). *Sangwijiyo* was an excellent model of merging knowledge of astronomy from the East and the West. Moreover, it has historical value as showing how the astrology of early Joseon evolved in the changing intellectual environment of the 18<sup>th</sup> century.

# Model study for water wheel control system of *Heumgyeonggaknu*

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## Abstract

*Heumgyeonggaknu* (欽敬閣漏) was automatic water clock, made by Jang Yeong-Sil (蔣英實) in 1438. It had a role of astronomical clock, realized the astronomical phenomena. It was installed at *Heumgyeonggak* (欽敬閣) pavilion which was important place for King *Sejong* to build his governance philosophy. At *Heumgyeonggaknu*, 4 season of *Binpungdo* (豳風圖, farming pictures) was drawn on the outside of *Gasam* (假山, imitation mountain) to study difficulties of cultivation of the public. Also, *Gigi* (欹器) was installed to be cautious about the power through the inclined vessel being compared to the power. *Heumgyeonggaknu* was high-tech clock, which the solar movement was synthetically directed, and had various time-signaling puppets to show time by striking bell, drum, gong at the foot of mountain, and twelve gods and twelve *Ongnyeos* (玉女) on flat land, and 4 gods (blue dragon, white tiger, red bird, black tortoise) and 4 *Ongnyeos* on the top of a mountain. *Heumgyeonggaknu* was operated by water wheel and water clock in *Gasam*. Water wheel was rotated by flux of Clepsydra, and rotation speed was controlled by *Cheonghyeong* apparatus. In this study, conceptual design was drawn to examine the power generation process of *Heumgyeonggaknu* organically. Also, water wheel control system, which could be used in the experiment, was suggested through design of 3D modeling and basic blueprint.

**The Direction system of traditional rites and its relation with  
equinoxes and solstices: A focus on 『Shàngshū(尚書)』  
「Yáodiǎn(堯典)」**

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**Abstract**

『Shàngshū(尚書)』 「Yáodiǎn(堯典)」 is shown a proceeding to observe the sun to enact the calendar and it is revealed to perform a rite the sun among Confucian scripture. *xīshi(羲氏)* and *héshi(和氏)* is lived at the 4 direction, in which eastern, western, southern and northern grounds by the order of *Yáo(堯)*. And then 4 persons who are charge of each directional ground, have to set the dividing point and solstice correctly. The 4 points in the solar term has vernal and autumnal equinoxes, summer and winter solstice, in which the direction structure is also divided four. In the view point of traditional rites, direction system will be closely related to the 24 solar term. Especially at the same time 4 points are equinoxes and solstice of summer and winter, that mean 4 directions. It is not only vernal and autumnal equinoxes, summer and winter solstice during an year that means a time order, but also those 4 points of direction indicate as space order. By the way, four-directions system in the traditional rites are not modeled on an order of solar term. Due to the diurnal motion, what the sun's moving is showed in the northern hemisphere will be 2way systems. when the sun reach at the points of vernal and autumnal equinoxes, the sun arrive due east and due west at that time. Otherwise when the sun reach at the points of solstice of summer and winter, the sun go up to the south, but go down the north. As a result, it is considered that traditional directions through 4 points of solar term in 「Yáodiǎn(堯典)」 is divided 2way systems. when the sun's operation is from east to west will be shown out and in, is from south to north will be shown up and down.

