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Commemoration of ancient Chinese mathematical master Liu Hui for his timeless influence on mathematics and civilizational exchange

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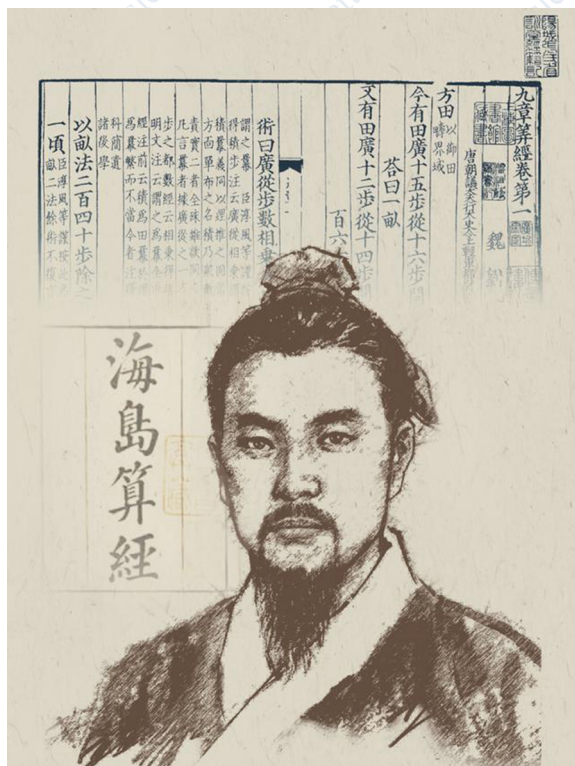
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Pioneer of Science

Commemoration of ancient Chinese mathematical master Liu Hui for his timeless influence on mathematics and civilizational exchange



Modern rendition of Liu Hui
Photo credit: Official WeChat account of VOC

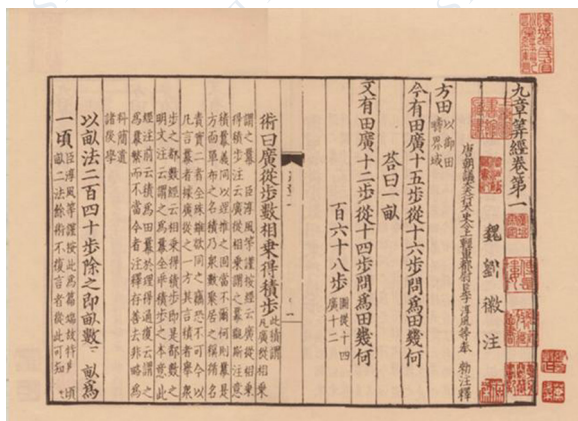
Throughout history, numerous individuals have left marks, and Liu Hui, a 3rd-century Chinese mathematician, was one of the most influential in the field of classical Chinese mathematics. His study of the ancient classic *Jiuzhang Suanshu* (*The Nine Chapters on the Mathematical*

Art) culminated in two landmark works: *Jiuzhang Suanshu Zhu* (*Annotations on The Nine Chapters on the Mathematical Art*) and *Haidao Suanjing* (*Sea Island Mathematical Manual*). These texts established the theoretical foundation of classical Chinese mathematics. Liu Hui's contributions not only shaped Chinese mathematical history but also influenced mathematical development across East Asia and, indirectly, the wider world. In recognition of his extraordinary achievements, the UNESCO designated 2024-2025 the 1800th anniversary of Liu Hui's birth. The commemoration celebrates his enduring legacy while showcasing the profound contributions of ancient Chinese science and culture to a global audience.

Jiuzhang Suanshu Zhu leaves lasting impact on mathematical development

Emerging in the mid-1st century BC and preserved

to the present day, *Jiuzhang Suanshu* contains numerous universal algorithms and mathematical problems. However, according to Zou Dahai, a research fellow at the Institute for the History of Natural Sciences, Chinese Academy of Sciences (CAS), who attended the commemoration event in Paris as an expert representative, the text lacks explanations for how these algorithms and formulas were derived, despite the rich content and academic achievements.



Excerpt from *Jiuzhang Suanshu* Zhu
Photo credit: Official WeChat account of VOC

Liu Hui's annotations, completed in 263, served as a crucial supplement to the original text by providing detailed demonstrations of its mathematical methods. "He also made original and significant contributions in various fields," Zou explained, "including the concept of *lǚ* (ratio), the method of infinite division, volume theory, indirect surveying, the ratio of circumference to diameter, and decimals."

Liu Hui defined the meaning of key mathematical vocabulary such as ratio, equation, positive and negative numbers, and square root, laying the groundwork for a unified framework of concepts. He introduced the

concept of *lǚ* and *Qi Tong* (the principle of uniformity) to connect various algorithms. Building on the area formula for rectangles and the volume formula for rectangular prisms, he developed the out-in complementary principle, the principle of proportionality between opposite sides of right triangles, and the Liu Hui's Principle (named by CAS member Wu Wenjun). Using deductive reasoning, he rigorously proved the formulas in *Jiuzhang Suanshu*, creating an organic network of mathematical knowledge. He likened this system to a tree, with distinct branches all originating from a shared trunk.

"From land measurement to urban planning, from building houses to constructing levees, Liu Hui's annotations not only introduce precise calculation methods but also provide rigorous mathematical proof," said CAST Executive President He Junke in his speech at the launch

ceremony. This creative journey serves as a reminder that advancing human well-being should be the ultimate value and goal of technological development.

(Sources: *Global Times* and the official WeChat account of VOC)

Events in Focus

UNESCO celebrates 1800th anniversary of Liu Hui's birth



A short video highlighting Liu Hui's contributions screened at the launch ceremony
Photo credit: *Global Times*

On September 24, 2024, the UNESCO headquarters in Paris hosted a special event to commemorate the 1800th anniversary of Liu Hui's birth. The gathering brought experts, scholars, and representatives from UNESCO member states together to celebrate the achievements of the great ancient Chinese mathematician and reflect on the profound impact of his contributions to global civilization.

Liu Hui's books and theories not only shaped the development of ancient Chinese mathematics but

also continue to inspire modern technological advancements and promote cultural exchange worldwide. The event's atmosphere was a blend of solemnity and vibrancy, as representatives from various nations delivered speeches honoring Liu Hui's legacy and expressing deep respect.

Lidia Arthur Brito, UNESCO Assistant Director-General for Natural Sciences, praised Liu Hui as a brilliant mathematician whose work left an indelible mark on human knowledge. She highlighted his innovative spirit and how his genius in geometry, logic, and numerical systems shaped the course of mathematics and continues to influence scholars globally. Brito emphasized that the commemoration was not only a tribute to Liu Hui's scientific legacy but also a reminder of the pivotal role mathematics plays in shaping the future.



The special exhibition at the Refectoire des Cordeliers in Paris
Photo credit: *Global Times*

This commemoration marked the first time China organized an event at the UNESCO headquarters for the anniversary of a scientist's birth. It aims to highlight the remarkable scientific achievements, innovative ideas, and significant contributions to human civilization of ancient Chinese scholars like Liu Hui. Over the coming year, similar events are scheduled in countries including South Korea and Azerbaijan.

(Sources: *Global Times* and the official website of CAST)

Beacon of wisdom continues to inspire the world

Many Chinese and international scholars attending the commemoration highlighted how Liu Hui's contributions to mathematics hold not only significant historical value but also offer insights for contemporary mathematical learning, scientific research, and youth science education.

"The achievements, ideas, and methods of ancient Chinese mathematics have long been integrated into the mathematics we study today," said CAS research fellow Zou Dahai. "Liu Hui's contributions are a vital part of



Visitors at the special exhibition
Photo credit: *Global Times*

this legacy, exerting both tangible and intangible influences on the development of Chinese mathematics." Zou noted that the concept of proportions that modern Chinese people learn, such as viewing fractions as the ratio of two numbers, is rooted in Liu's work.

In addition to Liu's mathematical accomplishments, "His scholarly attitude and scientific spirit are also worth studying and promoting," added Zou.

Jeff Chen, a mathematics professor at St. Cloud State University in the United States emphasized how Liu's contributions can inspire and enrich the science education of today's youth.

International Astronomical Union names asteroid after Liu Hui

On September 2, 2024, the International Astronomical Union's Minor Planet Naming Committee officially named an asteroid, discovered by the Purple Mountain Observatory of the Chinese Academy of Sciences, as the "Liu Hui Star." This honor followed the earlier approval by the International Astronomical Union of China's proposal to name several lunar features near the Chang'e-5 landing site, with "Liu Hui" being one of the eight selected names. Bak Sang Mee, Permanent Delegate of the Republic of Korea to UNESCO, expressed hope that the commemoration would not only bring greater global recognition to Liu Hui's work but also foster appreciation for the broader mathematical achievements of East Asia. By honoring Liu

Hui in this way, these efforts underscore his enduring legacy and the universal value of his mathematical innovations.

(Source: *Global Times*)

Special exhibition showcases Liu Hui's mathematical heritage



Entrance to the special exhibition at the Refectoire des Cordeliers in Paris
Photo credit: Official website of the National Communication Center for Science and Technology

From September 23 to 27, 2024, a special exhibition titled "Liu Hui: A Leading Founder of Classical Chinese Mathematical Theories" was held in Paris. It offered visitors a closer look at the scientific achievements and intellectual contributions of Liu Hui.

The event drew considerable interest from French visitors, many of whom expressed admiration for ancient Chinese mathematics and cultural heritage. "Look, this is Liu Hui's method of cutting circles—how interesting!" commented one visitor, noting the ingenuity of the technique.

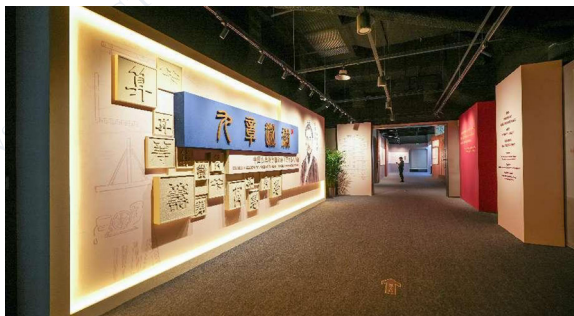
The exhibition, structured around Liu Hui's academic achievements, intellectual legacy, and impact, was

divided into five sections: *The Ancient Roots of Chinese Mathematics*, *A Scholar Formed by Tradition*, *The Inquisitive Mind of a Pioneer*, *A Man of Scholarly Integrity*, and *A Timeless Legacy*. These sections explored Liu Hui's contributions to mathematical theory and practice and their relevance to subsequent generations.

The exhibition design incorporated traditional elements, with deep blue and soft yellow evoking the colors of classic Chinese book covers. The content was presented through graphic panels, artistic sculptures, geometric motifs, and video presentations, creating a visually appealing and informative experience.

Visitors of various backgrounds engaged with the exhibits in different ways, from thoughtful reflection to animated discussions, with many capturing their experience in photographs. "This exhibition

gave me new insights into ancient Chinese mathematics," remarked one French scholar at the conclusion of the visit.



A similar exhibition on Liu Hui launched at the National Museum for Modern Chinese Scientists on October 22, 2024

Photo credit: Official website of the National Communication Center for Science and Technology

The exhibition combined recent archaeological findings and contemporary research, presenting a collection of historical materials with a focus on scientific accuracy. Its design drew inspiration from the culture of Wei and Jin dynasties, featuring elements such as calligraphy, seal carving, *guqin* music, poetry recitation, reenactments, and scientific models. This approach highlighted aspects of classical Chinese culture, offering visitors an opportunity to explore the relationship between mathematics and traditional Chinese culture, along with Liu Hui's notable contributions to the field.

The exhibition aimed to foster greater understanding and appreciation of ancient Chinese mathematical theories within the international community while also showcasing the intellectual achievements of China's cultural heritage.

(Source: Official website of the National Communication Center for Science and Technology)

Liu Hui's work links Eastern and Western civilizations



Liu Hui's cyclotomic method
Photo credit: *Global Times*

On September 24, 2024, an international symposium on Liu Hui's academic philosophy brought experts of the history of science, technology, and mathematics together to explore his contributions and their modern relevance. Scholars from China and abroad discussed Liu Hui's groundbreaking work, particularly his annotations on *Jiuzhang Suanshu*, which reflect innovative ideas that have exerted a lasting impact on mathematical theory. They highlighted Liu Hui's achievements such as his introduction of decimal fractions, his use of positive and negative numbers with defined rules for addition and subtraction, and his enhancements to solve systems of linear equations.

“Building on *Jiuzhang Suanshu*, Liu Hui introduced significant theoretical concepts, including ‘*Qi Tong*.’ He not only tackled practical problems but also approached mathematics from a higher, philosophical perspective,” noted Professor Andrea Bréard, Vice President of the University of Erlangen-Nuremberg in Germany.

The symposium also examined the global influence

of Liu Hui's mathematical ideas and discussed strategies to promote China's classical mathematical heritage on the world stage.

In parallel, a themed exhibition celebrating Liu Hui's achievements in mathematics opened in Paris. "The exhibition aims to highlight Liu Hui's mathematical contributions and foster cultural exchange and mutual understanding between China and the rest of the world," said a representative.

Zhou Xiaohan, an associate research fellow at the Institute for the History of Natural Sciences, CAS, commented that the exhibition served as a platform to highlight Liu Hui's significant contributions and the collaborative efforts of Chinese and international scholars to study ancient Chinese scientific thought over the past century. "Liu's achievements are not only a treasure for China but also a legacy of

human intellectual history,” said Zhou.

Jeff Chen, a mathematics professor at St. Cloud State University, United States, expressed aspirations to expand the reach of Liu Hui’s legacy. “I hope to organize more exhibitions and lectures on Liu Hui in major cities worldwide,” he said. “With UNESCO’s support, such events could ignite global interest in his work, inspiring more students to delve into the history of Chinese mathematics. This would foster dialogue, discussion, and cultural exchange between China and the rest of the world.”

“A theme of our time is exchange and mutual learning among different civilizations,” said Zou Dahai, a CAS research fellow, in a speech at the launch ceremony. “Indeed, our commemoration of Liu Hui today, as well as the academic achievements supporting these activities, are

exactly the product of civilizational exchange and mutual learning.” The event reflected China’s scientific achievements and scientific culture, highlighting both the unique characteristics and the universal value of Chinese mathematics. “This serves as a model for the diversity and harmony between Eastern and Western cultures,” Zou concluded.

(Source: *Global Times*)

Academic Legacy

Liu Hui exemplifies scientific integrity and timeless wisdom

Liu Hui’s innovative theories and methods such as his concepts of *lǚ*, the cyclotomic method, Liu Hui’s Principle, the double-differences method, the Steinmetz Solid, and calculations involving micro numbers, have exerted a lasting influence

on the development of mathematics worldwide. His contributions not only demonstrate exceptional talent but also reflect the richness of ancient Chinese scientific culture. International mathematicians attending the commemoration all praised Liu Hui’s work for its universal value and continued relevance.

“Liu Hui was an inspiring mathematical thinker,” said Christopher Cullen, Honorary Professor of the History of Science, Technology and Medicine in East Asia at the University of Cambridge, a Fellow of Darwin College and former Director of the Needham Research Institute. “His work deserves greater recognition beyond the specialized field of Chinese mathematical history.”

Liu Hui demonstrated a scientific approach characterized by practicality, humility, and consistency, setting a thoughtful example for academic research. He approached

each challenge with care and realism, questioning established ideas and emphasizing independent thought and careful analysis. His reasoning was always grounded in evidence, reflecting a spirit of precision and respect for knowledge. This approach highlights his dedication to understanding and problem-solving, leaving a legacy that continues to inspire and offer valuable insights. As Karine Chemla, a French historian of mathematics and former President of the European Society for the History of Science (ESHS), put it, “Liu Hui did not unquestioningly accept the authority of *Jiuzhang Suanshu*. Instead, he took a critical and empirical approach, making significant contributions to the development of mathematical thought.”

Liu Hui’s critical thinking and innovative approach led to insights that were highly influential for his time. He skillfully built

on earlier work while introducing his own ideas and solutions. For complex problems, he offered detailed methods that provided a valuable reference for later scholars. “Liu Hui’s annotations demonstrate clear mathematical reasoning and intellectual depth,” said Professor Andrea Bréard. “His introduction of concepts like *Qi Tong* not only addressed practical issues, but also added a philosophical dimension to mathematics, showcasing his forward-thinking approach.”

Liu Hui’s contributions highlight the value of openness and collaboration in advancing mathematical knowledge. Joseph W. Dauben, an American historian of mathematics, President and Secretary-General of the International Academy of the History of Science, and Distinguished Professor at the City University of New York, acknowledged Liu Hui’s enduring influence on the

history of mathematics. “Liu Hui emphasized the importance of mathematical proofs, focusing on clarity and justification—a significant approach for his time,” Dauben said. “His methods of calculating the circumference-to-diameter ratio and measuring distances were appreciated in China and also exerted an impact on mathematics in India, the Arab world, and medieval Europe.” According to Dauben, every culture brings unique contributions to science and technology, and human progress is built on shared knowledge and learning. Liu Hui’s legacy serves as a reminder that openness and cooperation remain vital for the global scientific community in addressing modern challenges.

Commemorating Liu Hui is highly significant. It recognizes his remarkable contributions while highlighting the rich legacy of ancient Chinese scientific and cultural achievements. By

embracing the scientific spirit of early pioneers, encouraging interdisciplinary collaboration between science and the humanities, and fostering

dialogue among civilizations, we can contribute to sustainable development. Such efforts pave the way for a global community of shared

future and a more promising tomorrow for all.

(Sources: thepaper.cn and the official WeChat account of VOC)



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