

SAW Three-Month Workshop:

Mathematical Practices in relation to the Astral Sciences

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**MATHEMATICAL REASONING IN EARLY (AND NOT SO EARLY) WRITINGS
ON ASTRAL SCIENCES**
Variations on the moon

Karine Chemla

(SPHERE, CNRS & University Paris Diderot, ERC Project SAW)

The talk relied on three sets of documents, taken from “classics” included in the anthology presented to the throne in 656, the *Ten Classics of Mathematics*. Li Chunfeng 李淳風 (602-670) and his associates had selected these classics, and ancient commentaries on them they perceived as worth including in the anthology. They prepared editions of these documents and wrote subcommentaries on most of them.¹

The pieces of the classics at the center of the talk, whose translation was provided, included: the section of the moon’s lag with respect to heaven, from *The Gnomon of the Zhou* (周髀, ca 100 BCE for the passages examined), with its 3rd century commentary by Zhao Shuang 趙爽 and its 6th century subcommentary by Zhen Luan 甄鸞; the first problem of 王孝通 Wang Xiaotong’s *Mathematical Canon continuing the Ancients* (緝古算經), with his own commentary on it; and pursuit problems from *The Nine Chapters* (problems 6.12 to 6.14).²

In a first part, I examined Zhao Shuang’s way of reasoning in his commentary on the data stated about moon’s lag in *The Gnomon of the Zhou*.³ My main

¹ Two critical editions of the anthology were published in recent decades: (QIAN Baocong 錢寶琮 1963, Guo Shuchun 郭書春 and Liu Dun 劉鈍 1998).

² In addition to the critical editions mentioned above, (Chemla and GUO 2004) gives a critical edition and provides a French translation of *The Nine Chapters* and the commentaries.

³ Among the critical editions, (Guo Shuchun and Liu Dun 1998), volume 1, p. 1-46, includes only some of the ancient commentaries. Christopher Cullen, *Astronomy and mathematics in ancient China: the Zhou bi suan jing*, Cambridge 1996, contains a translation of *The Gnomon of the Zhou [Dynasty]* into English.

point was to clarify a relationship between two sets of values that is regularly established in the astral sciences in Chinese: on the one hand, the cycle containing an integral number of solar years and an integral number of synodic months (19 solar years and 235 synodic months), and on the other hand, the respective daily travel of the sun and the moon with respect to the lunar lodges. The fact of taking the value of $365 + \frac{1}{4} du$ for the number of du in the revolution of the sun in one year is the key point allowing the double meaning of the value of $12 + \frac{7}{19}$ (number of synodic months per year, and number of du travelled daily by the moon with respect to the sun). The same relationship between the two sets of phenomena is also referred to in the first problem of Wang Xiaotong's *Mathematical Canon continuing the Ancients*, which was the topic of my second part.⁴

This problem deals with the determination of the new moon and gives values for the cycle evoked above that do not seem to have been used ever. This is one among several features that seem to point to the fact that the procedure is meant to be general. After the statement of the problem, Wang formulates a procedure and a commentary presenting a reasoning that accounts for the meaning and correctness of the procedure. In this problem, Wang Xiaotong claims to offer a “new” solution for the determination of the true new moon. The method he criticizes for its cumbersome computations and he suggests to replace by his own procedure seems to be that given in the *Wuyin yuan* calendrical system (戊寅元曆, enacted in 619), which Wang was appointed to examine in 623. Interestingly, only a few years later, in 627, Li Chunfeng is known to have criticized the same calendar and to have been accordingly appointed to the bureau of astronomy. Another important point is that Wang Xiaotong claims his procedure is “similar” to one given for a problem from *The Nine Chapters*. One might identify this problem as problem 6.12. Incidentally, this reference indicates the connection between this problem and the astral sciences. The grounds for similarity between procedures in Wang's claim appear to be the same as the grounds used by the commentator on problems 6.12 and 6.13 to claim the reasoning underlying the procedures solving these problems is the same: similarity means similarity in the reasoning grounding the correctness of the procedure. By contrast, Wang's reasoning does not use the concept of *lü* central in the extant commentary on *The Nine Chapters* and also central in Li Chunfeng's perception of the organization of mathematics. This led me to conclude on a question: was the commentary on these problems of *The Nine Chapters* that Wang read the same as the one we can read nowadays? I'll return in the future to this issue.

Bibliography

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⁴ This passage was for the first time for its greatest part translated into German and discussed in (Bréard 1999, 333-336, 41-43), respectively. (Bréard 2002) evokes the relationship between the problem from *The Nine Chapters* quoted and this problem by Wang Xiaotong as well as the relationship between pursuit problems and astronomical problems in other Chinese, Sanskrit and Latin sources. The overview given yields a very good starting point for an analysis of the relationship between pursuit and conjunction problems.

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