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The Formation of Zījs in the Integration of Indian and Greek Mathematical Tools

Abstract – Scholars in the medieval Islamic world received and reformed the Ptolemaic astronomical system found in the *Almagest*, and explored a physical cosmology by combining the Ptolemaic models with Aristotelian natural philosophy. As a result, they produced a distinctive genre of astronomical research on cosmology called *'ilm al-hay'a*, which was canonicalized by Naṣīr Dīn Ṭūsī (1201–1274) in *Tadhkira fī 'ilm al-hay'a*. On the other hand, they developed quantitative study of astronomy by composing *zījs*, which are astronomical handbooks containing tables and explanation for solving specific problems. Clearly, their tables were based on Ptolemy's *Handy Tables*; however, we must remark that their explanation part could not be based on the *Almagest*; for in the *Almagest* Ptolemy presented quite a few propositions with geometrical demonstrations to explain astronomical phenomena and concluded with compiling tables, but he never described solutions for solving particular problems. By reviewing the history of astronomy in the medieval Islamic world, we are reminded that the earliest *zījs* emerged as translations of Indian astronomical handbooks called *Siddhāntas* which consist of verses giving the processes of how to solve specific astronomical problems.

In this paper, I will elucidate how the *zījs* were formed in the integration of the mathematical tools developed in Indian astronomy and those in Greek astronomy, by comparing the solutions to a similar astronomical problem in *zījs*, the *Siddhāntas* and the *Almagest*. Moreover, I will point out that this integration produced a new mathematical tool, which was used for updating the *Almagest* around the time of Ṭūsī.