History of Science in South Asia

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J. M. Delire (ed.), Astronomy and Mathematics In Ancient India (Leuven, etc.: Peeters, 2012)

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BOOK REVIEW

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BOOK REVIEW

J. M. Delire (ed.), *Astronomy and Mathematics In Ancient India. Actes de la journée d'études organisée le 24 avril 2009 à l'Université Libre de Bruxelles*, (Leuven, Paris, Walpole MA: Peeters, 2012), 199 pp. *Lettres Orientales et Classiques*, volume 17. ISBN 978-90-429-2614-1. € 38.

Astronomy and Mathematics In Ancient India is an edited volume of collected scholarly articles on various topics in the history of astronomical and mathematical sciences in India. With contributions in both French and English, this book covers a variety of themes that were presented at a day-long colloquium in Brussels by an impressive group of international participants. The group, led by J. M. Delire, included P.–S. Filliozat, K. Mahesh, R. Mercier, F. Patte, K. Ramasubramanian, S. R. Sarma, and Venketeswara Pai R. The contributions are diverse in their range; from infinite series to instruments, mean motions to music theory to manda epicycles.

The book opens with a short editorial preface followed by seven contributions, each with their own reference section. The first contribution is by Mercier, who continues to tackle important issues surrounding the origins and generation of planetary period relations. His approach, inspired and guided by Billard, is to employ modern statistical tests and retrodictions of planetary positions to explore ancient parameters. "It is commonplace to test an ancient astronomical work by a recalculation from modern parameters of the state of the sky at that time," he clarifies, "indeed how else would one hope to date an ancient work?" (pp. 24–25). It is true that modern mathematical analysis can be useful in recovering historical information that is otherwise unavailable through conventional approaches. However, fully understanding the circumstances and details of ancient astronomical systems requires a multifaceted approach that harmonizes textual readings, contextual circumstances, as well as the inferences drawn from modern mathematical analyses. Caution must be exercised with respect to the conclusions made when one of these lines of inquiry is prioritised at the expense of the others. This point has been the focus of many recent historiographical reflections.[1]

1 For instance, in the context of tabular texts, Robson (2001) enumerates six conditions that she considers crucial: historical sensitivity, cultural consistency, calculational plausibility,

Furthermore, the use of *mean* motions to attest to observable physical phenomena is a delicate matter. Modern scholars who invoke modern comparisons to explore ancient data must make explicit all assumptions used in their reconstructions and comparisons to present a lucid and convincing case. Recent work, such as that done by Duke (2008) has made important contributions to this issue too.

Delire considers the construction of tables of sines, their features, and the various interpolation procedures that were developed to compute intermediary values. He situates such activity at the intersection of mathematics and astronomy and reconsiders important familiar passages from Āryabhaṭa to Nilākaṇṭha. Filliozat explores a work entitled *Haricarita* by Parameśvara Bhaṭṭa which incorporates the *vākyas* (or short statements which encode astronomical data) by Vararuci. He presents a small selection of verses to reveal the double reading that can be made of the text; the first reading reveals a verse relating episodes in the childhood of Kṛṣṇa, and the second reading which focuses on the the beginning of each verse, uncovers the true longitude of the moon, encoded using an alphanumeric coding scheme, known as *kaṭapayādi*. He notes that this type of literary form falls between astronomical, mythological, devotional, and philosophical genres.

Sarma gives a detailed description of the earliest extant Sanskrit astrolabe. In order to settle existing controversy surrounding its date and authenticity, he compares the instrument with passages from an early work on astrolabe construction, the *Yantrarāja* by Mahendra Sūri (with the text and a translation given in an appendix to the chapter). His account connects specific recommendations set out by Mahendra Sūri regarding the construction and detailing on astrolabes with the actual physical features of this particular instrument and the quality of the workmanship. His interpretations are supported by ample photographic evidence which is magnified enough for Sanskritists to read and appreciate themselves.

K. Ramasubramanian discusses the traditional Indian planetary model as outlined by Nīlakaṇṭha in his commentary on the *Āryabhaṭīya*. He carefully describes Nīlakaṇṭha's modifications to the tradition model that entailed, among other things, that the equation of centre for the interior planets should be applied to the mean heliocentric planet (and not to the mean sun). Such modifications raise a number of fascinating questions, the most compelling being what motivated these proposals? Ramasubramanian notes the observations made by Kerala astronomer Parameśvara in the early fifteenth century may have prompted a reconsideration of the model, however the precise ways in which these (and other)

physical reality, textual completeness, and tabular order (p. 176). This point is also discussed more fully in Brummelen, Husson, and Montelle (forthcoming).

observational records inspired revisions of the behaviour of celestial phenomena still remain to be clarified.

Patte explores a sequence of numbers that was originally inspired by a combinatorial rule given by Bhaskara II, and developed by later commentators, including Gaṅgādhara and Śārṅgadeva the author of the *Saṅgītaratnākara* (Ocean of Music) for the enumeration of various rhythmical patterns. His account gives a glimpse into the methods employed by Indian scholars for resolving complex problems which were generated in fields outside of mathematics. His contributions, like others in the book, remind contemporary historians of mathematics that much critical mathematical activity can be found outside traditional domains of mathematics.

K. Mahesh, Venketesvara Pai, and K. Ramasubramanian spell out various 'Madhāva' series for the computation of π, and some of the ingenious correction terms that were introduced to improve the convergence of these series. One marvels at these corrections, which are justified to the modern eye with recourse to some serious algebraic manipulation, but were somehow arrived at without symbolic styles of reasoning. Nīlakaṇṭha's reflections on the 'irrationality' of π are captivating. Again, the question of motivation immediately arises. What was the incentive for developing these extremely precise articulations of π. Were they actually used by working astronomers? Or were they developed largely for supra-ultilitarian purposes?

As Delire notes, the history of the astral sciences on the Indian subcontinent is seriously understudied. Many key works still need to be edited and translated and their contents analyzed, for specialists and non-specialists alike. Overall this book is a welcome addition that showcases ongoing research in this field. For those who are interested in specific topics, a detailed index would have been helpful and as would a general bibliography. Certainly given the wide range of topics covered, a way to further ramify the coherency between the contributions could have been to draw out and develop the common themes raised throughout the book, perhaps in an introductory chapter. In addition, editorial finesse could have been applied at certain points in the book to ensure a constructive and dispassionate scholarly tone throughout. However, all in all, this book is a testament to the dedication and expertise of scholars who are working in this field and will be an encouragement and inspiration for others.

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